THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XI. No. 251—14th YEAR.] LONDON, JUNE 3, 1862. [Subscription per Ann. 15s. in Advance 18s Credit. DOUBLE No. Price 1s.

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J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire Bricks, and every other article in Fire Clay, are promptly executed at their Works as above.

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J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water, and the largest Orders may be executed in a few days.

Gun Metal, and all other kinds of Cocks, Stocks, Dies, and Taps, Galvanised Tubes, &c.

N.B. All Goods thoroughly Tested before sent out, and Warranted.

TENDERS FOR AMMONIACAL LIQUOR.

THE Directors of the London Gaslight COMPANY will meet at Vauxhall, at ten a. m., on Wednesday, the 12th of June, to open Sealed TENDERS for their AMMONIACAL LIQUOR for one or two years, from the 30th of June.

Parties desiring to tender can ascertain particulars by application to the Engineer or the Storekeeper, at the Works, VAUXHALL.

The Directors do not bind themselves to accept the highest or any Tender; and will require the party to provide Security for the due performance of the Contract, if they think fit to do so.

BLAYDON BURN AND LOW BENWELL FIRE CLAY RETORT AND FIRE-BRICK WORKS, NEAR NEWCASTLE-ON-TYNE.

WILLIAM COCHRAN CARR begs most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the Manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other Articles in Fire-Clay, executed on the shortest notice, and on the most reasonable terms.

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THE Directors of the Independent GASLIGHT and COKE COMPANY, Haggerstone, are ready to receive TENDERS for all the AMMONIACAL LIQUOR made at their Works (about 4700 butts per annum), to be taken away in covered Tank-Barges, from the 24th of June next, for a period to be agreed upon.

Tenders to be sent to the Office, at HAGGERSTONE, on or before the 10th of June.

COAL-TAR.

TO be Let, the Tar produced at the works of the SUNDERLAND GAS COMPANY, from the 1st of July next. Quantity from 150,000 to 200,000 gallons per annum.

The Directors will receive Tenders until Tuesday, the 10th of June.

J. H. COX, Secretary.

Sunderland, May 22, 1862.

THE Directors of the Great Central GAS COMPANY are prepared to receive TENDERS for the TAR manufactured at their Works for the year ending the 1st of July, 1863. Particulars as to quantity and delivery may be obtained on application to the MANAGER at the Works, Bow Common Lane.

Tenders to be sent in on or before Thursday, the 12th of June next.

28, Coleman Street, June 2, 1862.

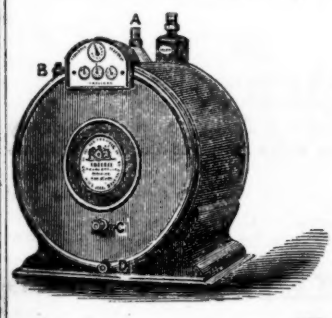
TO GAS COMPANIES.

ON SALE, by Private Treaty, at the Gas-Works, St. Helen's, Lancashire, a STATION-METER, capable of passing 7000 cubic feet per hour, with Bye-Pass, Clock, and Tell-tale.

Reference can be made to Messrs. WEST and GREGSON, Meter Manufacturers, OLDHAM.

Apply to Mr. WILLIAM PRITCHARD, Gas Office, ST. HELEN'S.

INTERNATIONAL EXHIBITION, 1862.



CLEGG'S
NEW PATENT
WET GAS-METER,
AS MANUFACTURED BY
BISCHOFF, BROWN, & CO.,
Will be exhibited in Class 31 B.

An Experimental Gasholder is attached, and the advantages of the Meter illustrated with explanations.

Price-Lists for Consumers, and
STATION-METERS, EXPERIMENTAL METERS, PRESSURE-GAUGES,
AND EXPERIMENTAL APPARATUS OF EVERY DESCRIPTION,
TO BE OBTAINED AT
LANGHAM WORKS,
GEORGE STREET, GREAT PORTLAND STREET, LONDON, W.

JOURNAL OF GAS LIGHTING NEWSPAPER

THREE
MEDALS AWARDED TO
THOMAS GLOVER'S
PATENT DRY GAS-METERS.

LORD REDESDALE'S "SALE OF GAS ACT."

DRY METERS *VERSUS* WET METERS.

LONDON, February 25, 1861.

THOMAS GLOVER begs to call the attention of Gas Companies and others to a few *facts*, which, if duly considered, must lead to most important conclusions :—

1. That since THOMAS GLOVER commenced to manufacture his Patent Dry Gas-Meters (which is now upwards of 15 years), every Wet Meter Maker of any importance in England has been compelled to manufacture Dry Gas-Meters; and in the JOURNAL OF GAS LIGHTING, of date of 12th of February, 1861, Messrs. William Parkinson and Co., successors to the late Samuel Crossley, advertise that they "intend manufacturing *Dry* as well as" Wet Meters, and it is worthy of particular notice that they intend to do so "after 40 years experience in manufacturing Wet Gas-Meters of such a quality that has enabled them, as they say, to maintain a superiority over all other; and this, be it also particularly noticed, after they had advertised in the JOURNAL OF GAS LIGHTING, January 29, 1861, "their improved low-spouted Gas-Meter with new patent float arrangement, which entirely overcomes the difficulty experienced by ordinary Wet Meter."

2. That it is quite consistent with THOMAS GLOVER'S knowledge that Wet Gas-Meters, called "low-spouted" or "compensating Wet Meters," have already been proved to be incapable of continuous working or registration, and for this reason the manufacturers of these Meters have been induced to seek the repeal of Lord Redesdale's (righteous) Sale of Gas Act.

3. That every year the Patent Dry Gas-Meter manufactured by THOMAS GLOVER has risen in favour with Gas Companies and Gas Consumers, placing him in the proud position of being the largest manufacturer of Gas-Meters in the country.

THOMAS GLOVER guarantees his Patent Dry Gas-Meters to meet all the requirements of the "Sale of Gas Act," to give accurate and unvarying registration with steady lights; and, from their peculiar construction, cannot be tampered with, and may be fixed in open situations even above or below the level of the lights. They work with less pressure than Wet Meters, and are not affected by the most severe frost.

THOMAS GLOVER guarantees to uphold all Meters sold by him for 5 years free of expense to the purchaser, or for a trifling per centage per annum will contract with any Gas Company to uphold their Meters of his manufacture for a series of years; and, at the conclusion of such contract, to leave the Meters all in perfect working order.

N. B.—Agents in several parts of England are wanted. Apply by letter, or personally.

WILLIAM PARKINSON AND CO.

(SUCCESSORS TO SAMUEL CROSLEY),

PATENT WET AND DRY GAS-METER MANUFACTURERS, &c.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

PATENT IMPROVED WET METER.

W. P. and Co. invite especial attention to this Meter, which entirely overcomes the difficulty to which ordinary Wet Meters are subjected, owing to the short range of the Float, which is necessary, in order to meet the requirements of the Sale of Gas Act.

"It is well known that in Meters constructed so that the valve will close when the water is drawn off to such a point as to render them 3 per cent. slow the lights are liable to be extinguished by the closing of the valve by a sudden increase of pressure. To meet this difficulty, Mr. Pinchbeck has invented an ingenious and simple arrangement by which the action is reversed, and any such increase of pressure, in his Meter, raises the value instead of depressing it. The fact of the improvement having been adopted by Messrs. W. Parkinson and Co. is a sufficient guarantee that it practically and effectually remedies the inconvenience it is designed to meet."—JOURNAL OF GAS LIGHTING.

PATENT IMPROVED DRY METER,

Which W. P. and Co. pledge themselves to manufacture with the same quality of materials and workmanship as in their Wet Meter, thereby giving Gas Companies and others the advantage of procuring a first-rate Dry as well as a Wet Meter, which, hitherto, they have been unable to do.

STATION-METERS AND GOVERNORS,

Which can be seen at all the London Gas-Works. Also Liverpool, Manchester, Sheffield, Nottingham, Belfast, Glasgow, Birmingham, Dublin, Bristol, Leeds, Leicester, Brighton, Southampton, Sunderland, Wolverhampton, Bradford, Norwich, &c., &c.

TEST GASHOLDERS, EXPERIMENTAL METERS, EXHAUSTER REGULATORS,

MINUTE CLOCKS, PRESSURE GAUGES, PHOTOMETERS, PRESSURE REGISTERS, &c.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

NOTICES.

The subscription is 15s. per annum, if paid in advance during the month of January, or 18s. credit, in two sums of 9s. each, in July and January of each year. Post-Office orders must be made payable at the Charing-Cross Money-Order Office, to William H. Bennett, No. 42, Parliament Street, Westminster.

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All Communications to be addressed to the Editor, No. 42, Parliament Street, Westminster; and orders for Advertisements to the Publisher, Mr. W. B. King, No. 11, Bolt Court, Fleet Street.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 3, 1862.

Notes upon Passing Events.

THE mismanaged Thames Embankment project has been the subject of one of the grossest instances of public interest sacrificed to private influence that has occurred for many years. It was, from the first, absurd that such an undertaking should be promoted in the form of a private Bill: it was, in every point of view, a national measure. The Thames does not belong to London alone; it is part of the capital, in which the whole country is interested. Whether it was from natural mental weakness, or from vanity, that the First Commissioner did not make the Thames Embankment a Government measure, we have no means of knowing. At any rate, this imperial question has been discussed as if it were a branch railway from Stoke Pogis to Bullock Smithy. We have the curiosity of a Government architect, Mr. Pennethorne, giving elaborate evidence against a Government measure; and we have the committee receiving, as decisive, arguments which the commission passed over with well-deserved contempt. The committee began by yielding to the pressure of the corporation of London—a corporation which, if it does little and does ill in the way of improvement, has an enormous obstructive power; and thus the street from Blackfriars Bridge to the Mansion House was given up. It might fairly be urged, in favour of this amputation, that it still left the future construction of the street an open question. A continuation of the river-side roadway to Queenhithe was, perhaps, a better thing, if the money could be found; and, if it could not, it would still be possible to execute the commissioners plan, either by the hands of the corporation or of the Metropolitan Board. But the last decision of the committee is fatal to the harmony, the grandeur, the utility, and completeness of the whole undertaking: it reduces the Thames Embankment to a botch and a makeshift. Yielding to the pressure of the Duke of Buccleuch and the other crown lessees, represented by that ex-Radical, ex-bishop-hater, ex-Secretary for Ireland, and present Conservative of mud-banks and stinks, Edward Horsman, M.P., the embankment, or, at any rate, the road, is to commence at Whitehall, leaving a blank between Whitehall and Westminster for the exclusive use of the duke and his followers. The job hatched under Mr. Pennethorne's protecting wings is so disgusting, that it is scarcely credible. In these days, when railroads are driven, without hesitation, through parks and pleasure-grounds—when the most unpleasant invasion of private property is treated, and properly treated, wherever public interests are involved, as a case for compensation, owners not being permitted, in committee, to resist the preamble of a railway Bill on the ground of residential damage—it is amazing to find a *majority* in a House of Commons committee deciding that such an undertaking as a Thames Embankment shall be truncated and deformed, because a Duke of Buccleuch desires a degree of privacy which neither the Duke of Devonshire, nor the Duke of Wellington, nor the Duke of Grafton enjoys. Her Majesty herself has never claimed for Buckingham Palace the sacred solitude which, it appears, is essential to the peace of mind of the inhabitant of Montagu House. This Scot cannot bear the idea of the public travelling

Betwixt the wind and his nobility;

even though the space of a long addition to his garden would divide his house from the road. The duke is one of those persons to whom a pleasing person and an oily manner have given the cheap reputation of a benevolent disposition. He has generally yielded to public opinion in England, and reserved the application of his overbearing feudal principles for Scotland—a country where the privileges of any duke on any question except religion are unlimited. In this instance, he has brought his Scotch principles to English ground, and endeavoured to spoil a great highway and a grand public improvement in order to satisfy his taste for urban seclusion. With a villa at Richmond, and half a dozen mansions in Scotland and England, he claims conventual retirement in the heart of Westminster. It is to be hoped that the House of Commons will not allow this flagrant inroad on a public work to pass without redress—that an appeal will be made to those who legislate on higher motives than the convenience of their personal friends—that the Bill, when brought up, will be recommitted to a committee not quite so open to class prejudices, and restored to its original harmonious proportions—at any rate, as between Westminster and Blackfriars. We have heard of no such case of abuse of private influence since, some twenty years ago, a nobleman proposed to send a railway two miles round, in order to save two pheasant coverts. But he had not the stubbornness of a Scot, and, after a waste of a thousand pounds or so in law expenses, yielded to the remonstrances of friends, looking forward to a county election.

The Sewage inquiry committee has collapsed, leaving behind it the evidence we have analyzed, a little business for the agricultural chemists, and the following brief report:—"1. That careful and exact experiments are necessary to elucidate the agricultural value of sewage, and the best mode of applying it. 2. That such experiments have been carried out at Rugby by the commission appointed to inquire into the best mode of distributing the sewage of towns, and applying it to beneficial and profitable uses. 3. That it is desirable that these experiments shall be continued during the present year."

These experiments, as explained in the appendix, will be made by dividing fifteen acres into three portions; applying sewag in the proportions of 3000, 6000, and 9000 tons per acre per annum respectively on one of each of the five-acre plots; to devote the produce of one five-acre portion to the production of hay; of the second, to the consumption of green crops by oxen; and the third, to be consumed in the same condition by milking cows." As oxen cannot be fatted advantageously on grass alone, it is proposed to give them, and the cows also, oil-cake. These experiments seem well planned, and will be the best results of the committee, although only a continuation of the work of the royal commission. In the second batch of witnesses, Mr. Benson, agent of the Duke of Bedford, at Tavistock, gave a rational, unexaggerated account of the sewage irrigation near that town, by which the duke had converted a nuisance into the source of very productive crops. Tavistock stands on a hill, and the sewage is conveyed to the land below by gravitation. Ninety-five acres have been laid out "in the ordinary way for water-meadows." So here again, in a recent experiment, the pet pipe and hose of the alderman and the C.B. are rejected in favour of a system of irrigation at least 300 years old. The Tavistock meadows are let to yearly tenants. Hay is made on a portion of them. Some of the land is let for £5 an acre. Land not worth 10s. an acre is now worth, including the supply of sewage, £3 an acre. The cost of laying out the land was £13 an acre—that is, for levelling, draining, and putting it into proper form; but not including the cost of the sewer or carrier. The tenants themselves did the pipe-drainage. The twenty acres now let for £5 an acre, previously let for £2 an acre. Mr. McCann, a builder and farmer at Malvern, takes, paying nothing, the sewage which the town previously paid another farmer £50 a year to use, and has successfully applied it to about fifty acres of meadow and Italian rye-grass. It seems, from his account, to answer well, although his evidence is not very precise, nor of a character to inspire great confidence in him as an agricultural authority; but, at any rate, he proves that he uses satisfactorily what would otherwise spoil a trout stream. Mr. Philip Skinner Miles, late M.P. for Bristol, related his management of fourteen acres with the sewage of his household of thirty individuals. His statements are vague, but modest; they derive their principal value from his being very wealthy, and an ex-M.P. The evidence of the late farm bailiff at the Annerley North-London Schools was in complete contradiction to Mr. Miles as to the value of sewage, but showed how, in the absence of sewers, sewage could be so disposed of as to avoid nuisance. The looseness of this witness's calculations may be judged from the absurdity of his putting down 1500 tons of sewage as equal to 24 cwt. of guano. The last witness, the mayor of Coventry, a medical man, gave the committee the benefit of his speculations on and in sewage; and there the inquiry closed, and with it all the hopes inspired by treacherous Dr. Brady in the breast of the zealous and unhappy Ellis. We say "treacherous," speaking in an Ellisian point of view. We believe the medical chairman was quite willing to call any number of witnesses, and meant to top up with our friend of the Arabian Nights, but the committee got out of hand, kicked over the traces, and, between Colonel Fane and Mr. Caird, absolutely refused to hear any second-hand information. But poor Mr. Ellis—although as a builder, no doubt, owner of a wheelbarrow, perhaps even of a donkey for braying mortar—was not the owner of even a quarter of an acre of lawn; and hence neglected he was left

> To blush unseen,
> And waste his sweetness on the desert air

of the lobbies—another victim to the tyranny of the Saxon.

Mr. Panizzi's magnificent reading-room has already been overrun by idle men and women, who go to the British Museum because they cannot go to a club, and there find seats, warmth, novels, magazines, and even society; and boys, who go to use "cribs and keys" to their lessons. The remedies suggested are, for the most part, absurd. One proposition is to limit the age, below which tickets may be issued, to 21. Age is neither a qualification nor a disqualification for a student. The editor of the *Examiner* has truly observed, that, "if age is to be the test, it would be wiser to cut off all the visitors over 40 or 50, than under 21. Boys may grow into something; pottering old men, hunting out the colour of the hair of Henry the Eighth's wet-nurse, are of very little use to any one but themselves." The true remedy is much more simple and direct. Let a librarian be placed in control of the room, with power to withdraw, at any time, the ticket of any one who seems to abuse it, leaving the party thus checked in his or her literary pursuits to appeal to higher power, if so inclined. As every reader writes his own name on the ticket under the title of the book he requires, there would be no difficulty in accumulating the necessary evidence. A printed form, handed to the offending parties on leaving the room, might state in general terms their offence against the rules of the Museum, and give notice that the ticket was cancelled; and an immediate interview with the officer appointed for the purpose might be offered. But the guilty would rarely face a personal explanation. The influence of the press would be quite sufficient to prevent this dictatorial power from being abused. The Museum reading-room is not a free library—a place where any one may properly go to pass spare time, or where schoolboys may get up their lessons—but essentially a place for study. No written rules will exclude improper persons from the Museum privileges; but written rules may exclude.

The Highways Bill is again before the House. Our public roads have outgrown the machinery of ancient legislation. Railroads have caused old narrow roads to be neglected or much used, and new roads to stations be required. While maintaining the principles of local self-government, we must not allow a superstitious reverence for worn-out institutions to stand in the way of road reform. The remedy, by indictment, for an ill-kept road is practically no remedy at all. The leaving the repair of roads to ignorant labourers, and small farmers not much wiser, is a very costly delusion. In the first place, we want the work well done; in the next place, economically. At present, a cross-country ride to a second or third class railway-station is a truly dangerous operation in winter or early spring. The first thing is to devise machinery that will efficiently repair the roads. The next, to make the tax-spenders responsible. This can be done between the board of guardians and the county magistrates. Instead of being afraid of the great unpaid, it would be wiser to increase their duties, for duties compel responsibility, in this country, of open discussion. When the magistrates have the management of the highways, elective boards for the management of county funds will not be far off.

Sir Hugh Cairns—than whom there could be no more competent man—has carried, without opposition, a motion for a commission of inquiry into the working of the patent laws. It was time: the cheapening of patents has led to a multiplication of patents and an increase of litigation very injurious to the manufacturing interests of the country. The improvements introduced by the Act of 1852 were very great, but have prepared the way for more. The provisional registration, the payment by instalments—*i. e.*, £5 on lodging the provisional specification, £20 at the end of six months, £50 three years later, and a final payment of £100 seven years later—abundantly encourage and assist inventors who produce anything worth protecting. Not less valuable to both patentees and producers is the provision for printing, indexing, and selling at a low price all past and future specifications. This part of the patent reform has been so well worked out, that already all the specifications registered since 1611 have been printed. The multiplication of patents since 1852 is at once satisfactory and alarming. In 1851, there were sealed 455 patents; in 1852, the first year after the new law passed, 2050; and, down to the present time, there are about 3000 provisional protections granted every year; and about 2000 patents sealed. One-third drop off in the first six months; two-thirds of the residuum at the next payment; and, at the end of seven years, the 3000 are reduced to about 200. The defects of the present system lie under several heads. The patentees justly complain that the machinery for trying patent causes is costly, dilatory, and unsatisfactory; juries being generally, and judges often, incompetent to understand the shades of difference in mechanical improvements and chemical combinations. This branch of law reform will no doubt be studied and agitated until some essential amendments are effected. It will be carefully sifted by the commission. On the other hand, the manufacturing public justly complain that they are hedged and harassed by a network of useless unworked or unworkable patents; that patents are taken out again and again for the same thing, and often taken merely as an advertising instrument, like the royal arms over shops, or, as a net to catch all the improvements that arise in a particular trade. It often happens, too, that a

patentee possesses himself of something that is of no use to him, but which would be of great use to some one else—as if, for example, one had a patent carriage body, and another patent wheels, each of little value without the other. We want, therefore, a tribunal more competent and a process more satisfactory than our present courts of law and equity, for trying patent causes. We want some machinery for annually sifting patents, and, by easy machinery, cancelling those which are but repetitions of old processes, or only held as monopolizing obstructions. We need, also, a competent court of arbitration for settling the terms on which any one may use an unworked patent, or part of a patent to be applied to some purpose not contemplated by the patentee. A patent of invention may be compared to a title to land. The landowner, up to a certain point, may do what he likes with it, but he can be compelled to yield up a portion of it for a highway, or a canal, or docks, or a railroad. Landowners may, and sometimes do, abuse their rights of property, but it has been found that security of tenure is the best security to the public for the improvement and cultivation of land. Lands held and cultivated in common, belonging from year to year to no one in particular, but every year divided by lot, were found, both in Ireland and England, to be farmed in the worst possible manner. But, when the land was divided amongst few individuals, and the rest of the commoners were compelled to become day labourers, the total produce of the common land was, after a few years, increased tenfold, to the obvious advantage of the whole population of the district. Patents rest on the same principles; they are intended to be a benefit to the community arising from a limited monopoly granted to a few individuals, tillers of an intellectual and inventive soil. Patents can be defended on no other grounds. We do not, in this country, profess to legislate on logical abstractions, nor trouble ourselves much about the rights of man. Patents are abused, no doubt, and so, sometimes, is the absolute ownership of land; but, no English politician would propose to return to commonage because some single, stupid landowner chose to grow weeds and rabbits, instead of roots and sheep. Patents for inventions give *security of tenure*, and thus while they encourage the ingenious to perfect their crude ideas, they discourage the secrets and mysteries which preceded the age of patents registered and made public. It is for the Legislature, to see that the privilege is not abused, that the leasehold shop we allow the patentee to set up on the national freehold is a convenience to public trade, not a nuisance nor an obstruction. Why does not Mr. William Hawes give us his anti-patent reasons, in a paper which would secure him the privilege of making two or three speeches instead of one? We know that he is never at a loss for words; let him show that he has also ideas and facts at command.

We have received, from a competent authority, the following notes on the project (mentioned in our last "Notes") for establishing a direct postal communication with Australia, by the Cape, without halting anywhere to coal:—"In the first place, ships of the size contemplated by Messrs. Buerstall and Campbell's project would each cost at least £300,000, and it would take six to work the line, thus absorbing a capital of £1,800,000. The total capital required, including stations, coals, &c., could not be put down at less than £2,000,000. Now, the capital of the West India Mail Company is only £900,000, and its dividends do not encourage rivalry in the same direction. The longest run, and the highest speed performed, by any mail steamer, is from Southampton to St. Thomas's, 3860 knots, averaging 10½ knots an hour. But this new Australian route supposes a run of 13,800 knots, and a speed of 12 knots per hour. This could be done, no doubt, but it would not pay. The Australian line has already ruined *four* companies; all tried to work it upon different plans. At present, the Peninsula and Oriental get £180,000 per annum for working it as a branch line, but it does not pay them, and they openly discourage persons from travelling by it."

M. Barral has a brief but happy sketch of the opening day at the International Exhibition, in the last number of *La Presse Scientifique*. He says: "The Universal Exhibition of 1862 was opened on the appointed day, with an exclusively English ceremony. The Exhibition was not complete; but the ceremony was very remarkable not only from the vastness of the crowd assembled, but from the strange antique costumes worn by many of the actors, and from their truly British self-composedness in a procession which would have been absurd if it had not borne so earnest and serious a character. This people is truly great, even in transactions that border on the grotesque; with them, facts outweigh forms. Still, we have a crow to pick with the English commissioners. Why was the ceremony of opening a building, to which all the nations of the world had contributed, exclusively English? The only foreigners for whom a prominent position was reserved were the Japanese ambassadors, whose costumes, to be sure, were in keeping with the curious caps, the monstrous wigs, and many-coloured robes of the municipalities of England, Ireland, and Scotland. Did the managers wish to prove to the representatives of Asiatic empires that there was only one empire in Europe—the British empire? This explanation is quite consistent with British arrogance." M. Barral's reproach is well-founded; but his theory, truly French and far-fetched, does too great honour to the diplomacy of the commissioners. We firmly believe that the gross blunder of omitting to include the representatives of foreign art, science, and manufactures, in the procession, was due to nothing but the sheer stupidity and mismanagement which have characterized all the arrangements. There certainly were some foreign commissioners in the Exhibition. We recognized one *Rouge* refugee—not a Frenchman—of 1848 marching proudly along, with a *rosette* in his button-hole. M. Barral does not explain how it was that France, with an organized central administration, and unlimited imperial funds, was as much or more behind than any other nation or colony. But we find in M. Barral's description such compliments to our arrangements as no Englishman dare venture on; and we almost fancy he must be sarcastic, when he compares the Horticultural Gardens to the Place de la Carrousel, and gives the palm of picturesqueness to the former. In M. Barral's future essays, we shall, perhaps, hear something of the facts of the discussion which has been going on as to the origin of the finest works of jewellery, wood-carving, and porcelain-painting. A Frenchman, in the *Constitutionnel*, has claimed all the success and glory in these art manufactures for exiles, his own countrymen. He is probably not far from wrong. The liberty and the liberal payments of England have for centuries attracted the refugees and the willing emigrants of all continental States—not Frenchmen only, but Germans, north and south, Italians, Spaniards, and Greeks, find here a home and a career, to the mutual benefit of themselves and this country. Every continental convulsion gives us some advance in art, science, and manufactures. British gloves, boots, and ices, as well as painting and modelling, were benefited by the troubles of 1848.

Circular to Gas Companies.

The public Bill, entitled the "Police and Improvement (Scotland) Bill," introduced by the Lord Advocate, which we noticed on the 8th of April last, was committed *pro formâ* on Monday week for the purpose of inserting numerous amendments, and it was ordered for reconsideration last night, but was adjourned until after the Whitsuntide recess. The intention of the Government is to carry out in Scotland the same objects which the Public Health Act and the Local Government Act effect in England; and any of the provisions of this Bill, if passed and brought into operation, would in all probability be referred to as precedents whenever it may be considered necessary to amend the law now in force on this side the border. It is, therefore, important to English gas companies, as well as to those of Scotland and Ireland, that the clauses should be rigorously scrutinized, and that the alterations made in the progress of the Bill through both Houses of Parliament should be carefully watched. The Bill, as first printed, did not empower the commissioners either to lease or to purchase the works of any established gas company, but clauses have been provisionally introduced for giving that power, which are so unprecedented in their character, and would if adopted as a precedent, so materially affect the value of the capital invested in gas-works in this kingdom, that they demand the most urgent consideration.

Though it is not proposed that the measure should be compulsory, nevertheless the inhabitants of towns, whether they are royal or parliamentary burghs, that have commissioners of police, would be unable to prevent its adoption, as the magistrates or commissioners may do so by passing resolutions to that effect. Considering this power in conjunction with that proposed to be conferred by the additional clauses, the commissioners might at any time resolve to purchase or lease

any gas-works at present erected, or to be hereafter erected within their jurisdictions, without consulting the wishes of the ratepayers. Even the arrangement proposed to be made with gas companies for lighting the public lamps are clogged with conditions which might place the companies in very difficult circumstances. By clause 129 it is proposed that, if the commissioners and the owners of gas-works "shall not agree as to the terms and conditions of the supply, and as to the price to be paid for such supply, then such terms and conditions and price shall be settled by arbitration." According to the Acts proposed to be incorporated in the Bill, the umpire, in cases of arbitration, is to be appointed by the Lord Ordinary, in the event of the arbitrators being unable to agree on his appointment; thus, a gas company might be forced into arbitration, and compelled to accept the decision of any inexperienced or incompetent man appointed as umpire, who might impose conditions with which it would be impossible to comply; such, for example, as uniformity of pressure and consumption, or other crotchets in which some would-be gas reformers indulge. The price to be paid for any services performed is a legitimate subject for arbitration; but great inconvenience and injustice might arise from intrusting to others the terms and conditions of such services without the consent of the parties called on to perform them. Those portions of the clause relating to the terms and conditions of the supply have been introduced since the Bill was first presented.

The powers to be given to the commissioners to purchase or lease gas-works are comprised in the additional clauses from 230 to 242 inclusive, of which the first two are the most important:—

230. For the purpose of supplying the inhabitants of a burgh with gas, in the event of its appearing to the commissioners expedient so to do, it shall be lawful for the commissioners, by special order only, to resolve to purchase or lease any gas-works already erected or hereafter to be erected, and any gasometers, retorts, machinery, mains, pipes, or other works, apparatus, or materials connected therewith, and any lands held or enjoyed therewith, and which gas-works and property connected therewith are hereinafter termed the gas undertaking; provided that no commissioner who is a shareholder in the gas undertaking proposed to be purchased or leased shall be entitled to vote at any meeting of the commissioners on any resolution relating to such purchase or lease; and provided also, that in case there shall be more than one gas-work erected in the burgh at the time of making such purchase or lease, the commissioners shall be bound to purchase or lease the whole of such gas-works.

231. The commissioners may enter into all necessary contracts and agreements with the owner or lessor of the gas undertaking for the purchase or lease thereof, and the amount of the price, annual dividend, rent, or other consideration to be paid therefor, shall be determined by arbitration in the manner provided by the said Lands Clauses Consolidation Acts, and not otherwise; and, in the event of the commissioners purchasing the gas undertaking from any joint-stock company, the commissioners may contract with such company, that the price thereof, to be determined as aforesaid, shall be a principal sum, or that the compensation therefor, to be determined as aforesaid, shall be made by a fixed redeemable annual dividend, payable by the commissioners in one sum, or in different shares and proportions to separate persons, or that such compensation shall be made partly by a principal sum, and partly by such fixed, redeemable, annual dividend; and the commissioners may enter into all the necessary contracts and agreements with such company with regard to the manner, terms, and conditions on which such fixed redeemable annuity shall from time to time be paid, assigned, redeemed, or discharged.

It will be seen that the commissioners and gas companies are precluded from completing any agreement directly for the sale of the works—the object of such restriction being to prevent jobbery in the transaction; but, as the essential condition of selling is thus left undetermined, very few gas companies, we apprehend, would like to enter into an agreement to sell, unless they knew, in the first instance, the sum they were to receive for the transfer of their property. The proposed settlement of the price by arbitration, with the probability that the value would ultimately be fixed by an umpire to be appointed by the Lord Ordinary, would, we conceive, operate as a sedative to any desire to part with valuable property. It is to be feared, however, that the possession of purchasing powers by the commissioners might promote continual agitation, and that the owners of gas-works might be thus induced to part with them at less than their real value. In the other clauses introduced in the Bill for confirming the powers proposed to be given to the commissioners, provision is made for the due payment to the company whose works may be purchased or leased, of the dividends to be received in those cases where the compensation is to be made by a fixed redeemable annual amount. The commissioners are empowered to improve or alter the gas undertaking they may have purchased, and to perform all acts requisite for the management of the works which the company might perform. They are further empowered to fix the rates to be charged, and the money they receive from the sale of gas is to be applied to the payment of the interest of the money borrowed for the purchase of the undertaking and to the disbursements chargeable against the gas department; and, if there be any surplus at the end of the year, after the payment of all such expenditure, it is to be applied towards the payment of such expenditure in the year following, "so that the gas-rates or rents may be proportionally diminished." We very much doubt, however, whether the 241st clause, which empowers the commissioners to raise money for accomplishing these objects, will be viewed with satisfaction by our northern brethren:—

241. Whenever the commissioners shall resolve, in manner hereinbefore provided for, to purchase or lease any gas-works and premises connected therewith, and to supply the inhabitants of the burgh with gas, it shall be lawful for them to charge all occupiers of lands and premises within such burgh, according to the said valuation roll, with a special assessment equal to but not exceeding ninepence in the pound of the gross yearly value of such lands or premises, over and above any other assessment or rate to which such persons may be liable under this Act, and which special assessment shall, for the purposes of this Act, be called the gas-rate, and shall be leviable and recoverable in the same way and manner as the police assessment is hereinbefore provided to be levied and recovered.

Ninepence in the pound on the *gross* rental is equal in some places to one shilling in the pound on the *net* assessment, and the possibility of its imposition will, we conceive, be sufficient to rouse the ratepayers to exert themselves to prevent the grant of such powers to the commissioners. The Bill will, in several other respects, require considerable modification, but the thirteen clauses which have been introduced authorizing the purchase of gas-works are especially objectionable, and we hope that the committee may be induced to expunge them from the Bill.

Another explosion of gas, under very remarkable circumstances, has taken place, which produced more destructive effects than any similar occurrence within our recollection. The locality of this accident was a narrow street leading out of Shoreditch, between the Eastern Counties Railway terminus and the church, the carriage-road of which was blocked up by the drainage works of the metropolitan middle-level sewer. The Commercial Gas Company have two 6-inch mains running under the foot-pavement on each side of the street, and over those mains the workmen had heaped piles of paving-stones. The weight of the stones caused a fracture or severance of the main on the south side of the street, and the gas escaped freely into the cellar and into the kitchen of an old house. A large volume of an explosive mixture of gas and atmospheric air was thus collected, and was ignited probably by the kitchen fire. The explosion that ensued entirely destroyed the house, and a great part of the one adjoining, and shattered the windows in the neighbouring houses on both sides of the street, presenting a scene of destruction for some distance. A portion of the gas-main was carried away by the force of the explosion; and, the gas having ignited, it issued in a roaring flame, until means could be taken to stop the flow of gas by bladdering the main. One woman was killed, and several persons were injured; but, the inmates of the house having been warned by the smell of gas, escaped unhurt. No blame can be attached in this case to the gas company, as the explosion was produced by causes for which they could not be responsible; but it affords an additional warning to contractors, in carrying on street works, to be more careful to avoid interfering with or damaging gas-mains or service-pipes. It may also be adduced as a caution against laying gas-mains under or close to the foot pavement, the danger of which the damage done by the late explosion in Holborn and the destructive fire in Wood Street also afforded serious examples.

The recent effort to raise a fund for the benefit of the widow and grandchildren of the late Samuel Clegg discloses, in a marked manner, the want of a provision for the relief of aged and decayed officers who have been engaged for a great part of their lives in the manufacture and distribution of gas. Nearly every trade has established benevolent institutions in our large cities; but as yet the gas trade has done nothing of the kind, and its members, when unable to support themselves, or to obtain assistance from their friends, have no other resource than the workhouse. Local clubs and benefit associations may, in some instances, have been formed for the relief of the working men; but we believe the "Benefit-fund" and the "Annuity-fund" established by the Paris Gas Company are the only funds in which the officers and staff of any gas company participate. The benefit-fund of the Paris company was established in May, 1858, and the annuity-fund was commenced in the following year. The former is supported by a deduction of 1 per cent. from all salaries and wages, to which the company add an equal sum. The object

of the fund is to give medical aid to the sick servants and labourers of the company, to pay half of their salaries or wages during their illness, and, in cases of death, to pay the funeral expenses, and to render assistance to their widows. The claims on this fund during the year 1860 amounted to £3048, which sum was rather less than the income. The annuity-fund is not intended to come into full operation until those entitled to it have been in the service of the company twenty-five years. Its resources are derived from gifts by the company of bonds and shares, and an annual subscription; and the amount possessed at the end of 1860 was £2690, in addition to 100 debentures and 13 half-shares of the company. It is a reproach to the gas companies of this country that no similar provisions have been made in England for the officers and labourers in their employ. We believe that if some of the directors of the principal companies, and leading members of the gas trade, were to form a committee, and to organize a "gas officers pension-fund," on a comprehensive basis, it would be liberally supported, and that adequate funds might be raised for the grant of pensions within a short period. The plan adopted by the Paris Gas Company of reckoning the date of service from the commencement of the institution, would not be applicable to a general fund raised for the benefit of deserving claimants in all parts of the kingdom, as we recommend. Benefit funds of a more local character, and formed on the Paris system, might be established with great advantage by each gas company independently, and they would not interfere with the more strictly charitable nature of a gas officers pension-fund, supported by the contributions of those who derive benefit from the manufacture and supply of gas, and of the public generally.

Another instance of the liberality of the Paris Gas Company has come to our knowledge, which we trust will find many imitators in this country. That company—now the largest in the world—are giving holidays of ten days each to their principal *employés*, to enable them to visit the International Exhibition—six being allowed to come at a time, and their expenses are paid by the company. During their stay in England, several of these officers will, no doubt, visit many of the London, and some of the provincial, gas-works; and we feel assured they will everywhere meet with a cordial reception.

Communicated Article.

GAS-METERS:

Wet and Dry.

By J. O. N. Rutter.

Which do you consider the best kind of meter—the wet, or the dry? Whose meters do you recommend? What is your opinion of the alterations lately made in A's meters? Have you much trouble with the meters made in conformity with the Sale of Gas Act?

Such questions, and probably half a dozen more of similar import, may be heard almost every day. They show a desire to obtain information; but at the same time, it is tolerably plain, that to ask questions is much easier than to answer them.

It is no part of my present purpose to discuss the relative, or actual, merits of wet and dry meters. Their various forms, the materials of which they are made, their principle of action, and the skill bestowed upon their mechanism, will, most likely, be referred to in general terms. Such references, however, will be incidental, rather than direct; and will not in the remotest degree point towards meters made by any particular person.

A great deal might be said about meters: their early history, the ups and downs which have attended them, their failures and successes; and the triumphs which patience, and courage, and perseverance have achieved. It would be very pleasant again to go over some of the often-trodden ground, to call up old recollections, and to fight again with some of the almost-forgotten objections and prejudices. But the subject is too interesting, rather, I might say, too tempting; inasmuch that it would be sure to draw off attention from what is just now of greater importance, namely, gas-meters, both wet and dry, in their practical and commercial aspects.

During many years, the wet meter had the field of operations to itself. Never was any machine worse used, or more abused. In its younger days, it had to struggle with prejudice, ignorance, and misrepresentation. When it grew older, its course was not much pleasanter; for, on the introduction of its rival, it was accused of offences of which it never was, nor ever can be guilty.

Doomed to labour almost unknown and unnoticed, in dark cellars and dirty out-houses; in kitchens, cupboards, and areas, the meter has always been an object of aversion and undeserved suspicion. But, it is the best friend which gas companies have ever had. The benefits it has conferred on them, and on society in general, are beyond all calculation. No language which I can employ will sufficiently proclaim its praises. In extending the uses, in simplifying the applications of gas, and in equalizing and cheapening its prices, the meter has had no equal.

These things are not sufficiently understood, or, if known and understood, but seldom acknowledged. There are many houses where a gas-meter has been at work for years. As long as everything connected with the gaslights has gone on pleasantly, no notice has been taken, and no inquiries made, of the careful accountant. Let the supply of gas be deficient, the lights burn unsteadily, or suddenly go out, or let the rate of consumption be a little greater than ordinary, or the meter, by long-continued hard work, have some part of its mechanism deranged, or worn out; and its past services and uniformly good behaviour are instantly forgotten. Listen to the abuse it receives! One would suppose it had always been ill-behaved—always troublesome—always unfaithful; just as bad as servants who spoil the dinner, make too free with the wine, or run off with the plate.

Weighing and measuring, according to local or general customs, and the nature of the commodities, are so well understood, and so necessary between buyers and sellers, that they need only to be mentioned to illustrate the principle to which the meter is applicable. There is nothing mysterious about it. Simplicity and fidelity are its most remarkable properties. It differs from ordinary measures of capacity in its form, and in being self-acting; but, it is just as much a measure as the commonest of them.

Nor is there any uncertainty in the operations of a gas-meter. Properly adjusted, and fairly treated, it is pre-eminent for accuracy; greatly surpassing all ordinary kinds of measures. Look at pint or quart measures for milk or beer; or smaller or larger measures for wines, spirits, or oil; or look at the measures, and the methods of using them, employed in the sale of corn, seeds, fruit, vegetables, and a hundred other articles in daily, hourly, demand. Are such measures—standards as to legal accuracy though they may be—deserving the name of standards of perfection in their uses and management? It is impossible to fill and empty ordinary measures without error or waste.

It has become so common a practice to find fault with gas-meters, that many persons, who ought to know better, are guilty of it. If a small portion of the time spent in grumbling had been devoted to a careful examination of the principle and the mechanism of these useful instruments, there would be fewer complaints. Knowledge inspires confidence. All that need be known could be acquired in a few minutes, and then everything would be intelligible, and, because understood, perfectly satisfactory.

What has a meter to do, and how does it perform its duties? Attached to the pipe through which the gas passes to the premises of the consumer, the meter acts as a sentinel; guarding the passage so as, on one side, to protect the consumer, and, on the other, the gas company. It is under the control of the consumer; working or standing still, moving quickly or slowly, entirely at his bidding. The consumer receives no gas without its first passing through the meter. In so passing, it is measured, and the quantity recorded. Never was there a happier thought, or a more wonderful contrivance; an impartial witness to the transactions between buyer and seller, and an accountant whose honesty cannot be impeached. All this seems easy enough to think and to write about when the process is understood, and when what is going on inside a meter is as present to the eye of the mind, as its external parts are visible to the bodily eye. Here is the chief difficulty. A mystery has been made, or pretended to be made, of what is no mystery at all; whilst those who ought to have taken most pains to make the principle and the merits of meters known, have shown the greatest unwillingness to do so.

The wet meter—so called because its operations depend on the presence of a certain quantity of water—performs its duties by the agency of a revolving-wheel. Call it a water-wheel, and it is not far wrong; the power being applied to the inside. This wheel is divided into separate compartments, so constructed that, whilst gas is entering any one of them, the same quantity can pass out of the meter only from that next adjoining. The wheel is set, and kept, in motion by the gas, which, entering from the street-mains, makes an effort to force itself into the house. The meter so far resists its progress that it is compelled to enter each compartment of the wheel in succession, and to remain a longer or shorter period, according to the quantity required. When no gas is consumed, the measuring-wheel stands still. By very simple mechanism, and the aid of the water in which it is more than one-half immersed, the wheel becomes a continuous measurer, and does its work without loss or mistake.

The quantity of gas which all the compartments of the meter contain being ascertained, or, in other words, the exact quantity admitted into and passed out of the wheel at each revolution being known, it only remains to provide means for recording the quantity in any given number of revolutions. A few wheels and pinions, such as are used for clock-work, effect this object. So long as the meter is in good order, and contains the proper quantity of water, all the gas which enters the house must pass through it; and that which does so pass is measured, and the quantity recorded.

Let it be understood that the meter is subject only to the direc-

tions of the person on whose premises it is fixed. It will move faster or slower, according to the quantity of gas consumed. The officers of the gas company take an account of the registrations, and see that the meter is in working order. In other respects, they have no more control over it than they have of the meat and bread, or the tea and sugar, in the customers' houses.

The dry meter differs greatly, but not essentially, from that just described. It is different in form, in some of the materials used in its construction, and in its mechanism. The wet meter is made wholly of metal—several kinds of metal. The dry meter is made partly of metal and partly of leather. A principle common to both instruments is, separate compartments of known capacities, continuous measuring, and the contrivance by which, whilst gas enters one compartment or chamber, a similar quantity passes out of that next adjoining. An uninterrupted flow of gas through the wet meter is caused by the rotating of the wheel, which, although divided into separate chambers, has them so contrived that, whilst one is filling, the next to it is emptying, and so on successively. In the dry meter, the same object is effected in a totally different manner. The motions of the measuring-chambers are alternating —one expanding, and the next to it collapsing—yet, in such a way that the gas passes as steadily as if its course were direct through one chamber only.

The measuring-chambers of the dry meter, being made partly of leather, are very sensitive to the impelling force (pressure) of the gas; and, by a series of levers, control the valves and work the index.

This must be sufficient as a popular explanation of each kind of meter. I shall have to say more about their internal arrangements by and bye. It is not to be expected that those who give themselves no trouble about such matters will understand what I have written. Such persons, in common fairness, ought not to find fault by hearsay.

Whatever may have been, or still may be, the defects of gas-meters—whatever may be the occasional inconveniences, or, as some may call them, annoyances attendant upon their use—they are not so defective, nor so troublesome, as they are represented to be. In the history of the mechanical arts, has there ever been an example of an instrument which has been so practically useful, so universally adopted, or which, adapting itself to the drudgery of every-day life, has so nearly attained perfection? It is only those who know how a meter is made, and, whether wet or dry, can comprehend its principle of action and the accuracy of its movements, who are competent to form any opinion of its value commercially.

Like every other invention which has to pass through many hands, and which is constructed according to the skill and taste of the respective manufacturers, meters, both wet and dry, differ among themselves. In each kind, there is identity of principle, but variety in the details. This is what should be wished for, and might be expected: the kind of rivalry which, keeping on the right track, leads to successive improvements. Thus it has happened that the efforts of the makers of dry meters, in which the mechanism is more delicate and facile than in the other kind, have had their good effects. Wet meters have been greatly improved, especially since it became necessary to make them in conformity with the provisions of the Sale of Gas Act.

Some meters are better than others, working more easily, causing less trouble, and being more durable. It would be something out of the ordinary course of things if it were not so. In trying to think of the number of manufacturers of meters, and of the hundreds of thousands of these instruments in use in various parts of the world, it is not very difficult to suppose that where there have been such marvellous successes, there may also have been some failures.

Now, let me say something about meters in another aspect, still looking at them fairly and impartially, but trying to find out whether they are constructed on scientific principles; good and useful as they are, whether they are susceptible of improvement. The philosophy of meter making is not what I mean; that would be too large a subject, and is not required for my present purpose. It is the science of meter making to which I am going to refer, and which, I believe, has never received the attention it deserves. The sense in which I understand and shall use this term is, the relations which the materials employed in the manufacture of meters occupy in respect to each other. It would be of importance to know, and we ought to know, whether the various kinds of metals of which meters are made are the best which could have been selected for the purpose; whether it has been sufficiently considered that one kind of metal is antagonistic to another, and that its presence there might not only be injurious but destructive to itself or to others.

These questions are deserving of consideration, and directing attention to them was never more necessary than at the present time. The manufacture and sale of meters are daily increasing. Very large sums of money have been expended, and still larger sums will hereafter be required, in the purchase of these instruments. Has all been done which ought to have been done in the choice of materials? Has the adaptation of metals to the passive and active parts of meters received proper attention? When it has become evident that one part, and the most important part, of a meter has been more quickly destroyed than another, what has been done in the displacement of the offending or offended metal, and the substitution of another? Put into plainer words, and which are easily understood, the question is this: have the manufacturers of meters sufficiently bestirred themselves, and done all that ought to be expected from them; and can it be said that meters are made upon truly scientific principles? If susceptible of improvements, why are they neglected or delayed? If anything can be done to add months or years to the average period of a meter's existence, is it not worth trying for?

In the fewest words possible, whilst doing all I can to avoid making the subject more difficult than it need be, let me mention a few examples illustrating the properties and habits of metals, showing how stubbornly they resist, and how readily they yield to, certain influences, what are the effects produced, and, so far as we understand such things, what are the accompanying phenomena.

Take a piece of zinc, immerse it in diluted sulphuric acid, contained in a glass vessel, and attend to what happens. There is a gentle hissing noise, followed by the disengagement of small bubbles of gas, which have a pungent and unpleasant odour. Wait a little, and the piece of metal will be gone—dissolved in the liquid; from which, by evaporation and other suitable means, it can be again recovered, but, in a totally different form. The metal will be there, but not like what it once was, for it has been changed into white fine-pointed crystals—the crystals of sulphate of zinc—sulphur and zinc chemically combined.

Try a piece of iron. The process will be somewhat similar to that just described; but it will go on more slowly, and the crystals will be larger, and of a pale green colour. These are sulphate of iron—sulphur and iron in chemical combination. So, also, a piece of copper might be similarly treated. In this case, the crystals are of an intense blue colour. Now, try a piece of lead. Do you expect to witness the same results as with the zinc, the iron, and the copper? If you do, you will be disappointed. Sulphuric acid has scarcely any perceptible effects upon lead, and for that reason it is the metal chiefly employed in lining the chambers in which the acid is manufactured.

In citing these few instances of what are called chemical action, or chemical decomposition, and which demonstrate the power which one material has over another—how it tears it to pieces, alters its appearances, and changes its properties—converting substances the most destructive and violent into others comparatively inert and harmless, we have examples, in a small way, of what is incessantly operating throughout all nature. Changes—wonderful changes—are effected by innumerable processes; and which are as actively at work amongst all the things which man has devised, although not so impressively visible, as they are in the budding trees, the growing crops, and the ripening corn. These changes minister to man's necessities; they do more, for they are inseparable from the commercial relationships, and the social enjoyments, of the whole human family.

But it is time to go back, and talk a little more about the zinc and the other pieces of metal—instances of chemical action, and which is accompanied by the development of electricity. This is the usual form of expression; but, I believe we are likely to be nearer right by saying that electrical disturbances produce chemical changes.

If we take a small piece of zinc and copper plate—say, an inch long and half an inch wide—and solder to one end of each plate a convenient length (about 2 feet) of copper wire, and place them in such a manner that they may not touch each other, in a glass of water, to which a few drops of sulphuric acid have been added, we shall have, in its primitive and most simple form, a voltaic arrangement for generating galvanic electricity. The instant the dissimilar metals are immersed in the acidulated water, they begin to influence each other; in reality, they begin to destroy each other. It would be, in the circumstances described, a slow process—but, because slow, not the less certain. There may be no hissing noise, no ebullition of the water, no perceptible escape of gas—but there will be a current of electricity at work between the two pieces of metal. How can we know this? Nothing remarkable is seen, or heard, or felt. How can the presence of this destructive agent be revealed? No fact in physical science is more easily demonstrated. A tolerably sensitive galvanometer is all that is required. Connect each of the wires with the instrument, and the magnetized needle, which before was stationary, will begin to move—deflected to the right or left, according to the positions of the metals. This is effected by electro-magnetism—the existence of inconceivably feeble currents of electricity being thereby made manifest, whilst we are also helped to judge a little of their relative forces or intensities.

Keeping on the track of the experiment just described, we have only to vary the conditions, and operate with other kinds of metals, and we shall get at the sort of information, relating to wet meters, which we should be anxious to possess.

Instead of placing both pieces of metal in the same glass, they may be separated—another glass being provided for the copper, and plain water only used in both glasses. By doing this, what is called the circuit will be broken, and no visible electrical effects will follow. To renew the communication, a piece of wire—say, 2 feet long—must be used; its ends, properly cleaned, dipping into the water in each glass. The oscillations of the needle will be less violent than before, because of the distance the current has to pass through the wire. In this way, it may be more convenient to pro-

ceed than with the metals in one glass; varying the experiments, and noting the relative forces as indicated by the arcs of oscillation. Let it not be forgotten that, truthful, intelligible, and convincing as are these indications of the presence and power of a really wonderful agent, there are many precautions, and many delicate and difficult manipulations required, before we get beyond the limits of approximate results. It is only those who know something about this kind of work, who are prepared to bestow upon it the care, and patience, and watchfulness which alone insure success.

Laying aside the pieces of zinc and copper we had been operating with, and taking others, carefully cleaned, and of the same sizes, let them be placed in common water (spring, river, or rain), and then in distilled water, noting the deflections when in one glass, and in separate glasses. In the same way, we may proceed with the following metals in pairs—namely, tinned iron (tin plate) against untinned iron, and with specimens of both new and old; a small piece of drum-shaft against a piece of (white metal) drum, new and old; a piece of drum-shaft against a piece of fine solder; a piece of a spout against a piece of drum-shaft. Another series of variations is necessary. Instead of common and distilled water, repeat each of the foregoing experiments with water drawn off from meters which have been at work—say, six, twelve, and eighteen months respectively. Change the order of proceeding once more, and operate in meter water, with one glass, as follows—namely, a piece of a drum against a piece of the same drum; tin plate against tin plate; solder against solder; shaft against shaft; iron plate against iron plate; cast iron against cast iron. In each of these last-mentioned experiments, after carefully observing the effects upon the needle, whilst each of the pairs of metal is as near as possible alike, let one piece of each pair be scratched with a knife, and the results noted.

Numerous as these experiments are, their number could be increased. Determinately abstaining from making known what have been the teachings of my own experiments, I am only the more anxious to set in motion right thoughts in others. There are very many persons who are interested in these investigations in a way that I never have been, and am never likely to be, and who ought to bestow upon them more consideration than they have yet received, but which they certainly demand.

It now may be asked—what is the meaning of all this? If there be currents of electricity of greater or lesser force set in motion, and kept in motion by contact or by working together of dissimilar metals, what has that to do with meters? Do you mean that these electrical currents are injurious to meters, that they, in any way, impair their efficiency, or shorten their existence? I do. It is no new thought of mine that in getting together the several parts of the wet meter, and which was a work of long-continued experiments, attended by innumerable disappointments, mistakes, and failures, there, probably, never was a similar instance in which, of course unconsciously, so many materials, mutually antagonistic, were contrived for working so closely together. Viewed in this way, the wet meter is what might truly be called a galvanic arrangement, its most vulnerable parts being electrically opposed to, and, therefore, destructive of, each other.

Here, as often occurs, we have a very beautiful illustration of practical experiences greatly excelling theoretical reasonings. Notwithstanding original defects in the choice and adaptation of materials, the wet meter has done good service. Compensatory influences, such as were not suspected, nor reckoned upon, came to its aid; and, in its earlier days more especially, helped to prolong its durability. It is not so now. Twenty or thirty years ago, gas-meters moved at the old road-waggon pace; they now have to move, like many other things, at express rates. When gas was 15s., 12s., or 10s. per 1000 cubic feet, meters had an easy time of it. It is different in the present day. Many thousands of meters now do more work in an hour than their predecessors used to do in a week.*

Whatever be the causes, nothing is more certain than that wet meters wear out, or are disabled, in shorter periods than formerly. The costs of repairs and renewals, are heavy items. This is not the worst of it. The interruptions to the ordinary course of business, the time and attention, when properly inspected, which meters occupy, the losses to gas companies which their being out of order occasion, and the complaints and dissatisfaction of customers, are of greater consequence than the money expended.

Can nothing be done to prevent, or at any rate, to mitigate these inconveniences? Are wet meters, in this sense, so perfect that no further improvements can be made in them? Is nothing to be suggested, by way of compensation, for the greater amount of work they have to perform? Is it not possible that by using other, and better adapted, materials, those which are known to be the weakest part of meters could be made the strongest? Something ought to be attempted. Wait a little. We shall see.

(To be continued.)

Correspondence.

CLAY RETORTS AND EXHAUSTERS.

Sir,—I have read the "Remarks on Clay Retorts," by Mr. Keeling, of Reading Gas-Works, which appeared in the last impression of your Journal, with some interest and curiosity. As his observations on the relative value of different shaped retorts, and the most advantageous number to be set in one oven, as well as his low estimation of the utility of an exhauster, are only advanced as opinions—though he bases some rather decided conclusions on them notwithstanding—he will, I hope, not be offended at their being taken for just what they are worth.

Mr. Keeling tells us that the gas is of better quality when generated in a D-shape than in either the round or oval-shaped retort; and further, that the D-retorts are better seated in the ovens, and offer more regular surfaces to the action of the fire than either the rounds or ovals. Now, if the latter of these statements were true, the former *might* be possible, but it seems to me to be more in accordance with reason that fire, playing round circular or oval retorts, will impart its heat more regularly than when striking against the angles of D-shaped ones. Indeed, so well is this recognized, that many who use D-retorts assimilate them as much as possible to the round or oval shapes, by having them made with the angles rounded off. Nor can I admit that there is greater stability in a setting of D-retorts than in circulars or ovals. On the contrary, I believe just the reverse to be the case, an opinion the correctness of which, I think, will be recognized by gentlemen who have set on both plans.

I fear I shall be equally unable to agree with Mr. Keeling in his statement, taken in an unqualified sense, that more than five retorts should not be set in one oven.

In small works, beds of five retorts may be more convenient for lighting up and letting down than larger settings, but my experience has satisfied me that a lighter fuel account, in proportion to the quantity of coals carbonized, will result from well-arranged settings of six or seven than from beds of five retorts. There is also to be considered, among other reasons that might be given in favour of settings of more than five, the question of economizing retort-house room—a very important one in many gas-works.

The objection urged against beds of more than five—viz., that some of the retorts must be either inconveniently high or low—is more imaginary than real.

But the most striking part of Mr. Keeling's communication is, his assertion that he can get as much gas per ton of coals, and of as good quality, without an exhauster, as where one is used—a statement so much at variance with the experience of those who use one, that I should certainly have been inclined to question its correctness, had that gentleman not informed us that he produces 5000 feet of gas in twenty-four hours from a small D-retort, 15 in. by 13 in. by 8 feet 6 in. long, without the aid of such a machine. Mr. Keeling adds: "I do not think more can be produced with an exhauster; and I am quite sure I could not produce that amount from round or oval retorts of the same capacity"—a statement in which I quite coincide.

I should be sorry to insinuate, for a moment, that Mr. Keeling has been guilty of either the *suggestio falsi* or *suppressio veri*, but his carbonizing results are so *very* favourable, that I, for one, would be obliged by being furnished with the "maximum of information" as to the kind of coal he uses, the per centage of his fuel account, the duration of his retorts, the temperature at which his gas is measured, and last, though not least, the quality of the gas. That information might, probably, somewhat modify the 5000-feet flourish.

Considering the diminished capacity of the retorts by the rapid incrustation of carbon, owing to the want of an exhauster, I suppose it will be admitted that 2¼ cwt. of coals is a fair average charge—taking the year through, and old retorts with new—for retorts of the size given by Mr. Keeling; and, presuming that he works the usual 6-hours charges, that gives a production of 5000 feet of gas from 9 cwt. of coals, or over 11,100 feet per ton of coals, which suggests the query, not whether "the gas is of as good quality as where an exhauster is used?" but whether Mr. Keeling's company are under any restrictions as to the illuminating power of the gas they supply?

E. S. Cathels.

Gas-Works, Shrewsbury, May 26, 1862.

* It is due to the memory of the late Mr. Samuel Crosley, who did more than any other man to make the wet meter a practically useful machine, to mention here that he was not unacquainted with the effects of electricity upon the metals and metallic alloys used in his meters. During about five years, Mr. Crosley was examining, as well as could then be done, the chemical effects of gas products on metals, and in that way he decided upon what he considered best for his purpose. At a later period (1838) I was engaged for several months in conducting for him, and with him, a series of electro-magnetic experiments, similar, in many respects, to those here described. I well remember that Mr. C. often expressed surprise at results then so new and so unexpected. When completed, with his usual exactness, he reduced the experiments into a smaller space than I ever thought they would occupy; and, by a system of curves, showed wherein they agreed with, and wherein they differed from, his chemical experiments. Since the period above mentioned, I have learned a great deal more about electrical forces and phenomena than I then knew; whilst I have had the teachings as well as the warnings of an instrument so sensitive, that it is influenced as readily through eight miles of interposed wire, as that used in 1838 was through the same number of yards. The latter was one of the best of that day—made by the late Mr. Watkins, of Charing Cross.

IRON *VERSUS* CLAY RETORTS.

SIR,—Observing, in your valuable JOURNAL of the 20th inst., some remarks upon clay retorts, I beg you will be so kind as to give publicity to this communication. Having had fifteen years experience in gas-making, I hope that no further apology is necessary for offering a few observations relative to the working of iron retorts against clay retorts.

In small gas-works, the latter are very apt to leak, in letting the heat down, and allowing the best quality of gas to escape up the chimney, when worked without exhauster; but I am of opinion that more gas can be got from a ton of coals by working with an exhauster than without, as it lightens the pressure on the retort; and, under a light pressure, the gas is not so quickly decarbonized in the retort. I have worked one iron retort, 6 feet 6 inches long, 13½ by 13 inches inside, D-shaped, from Sept. 25, 1861, to March 25, 1862, and in that period the consumers meters have registered 714,100 cubic feet, besides the gas consumed in 17 town-lamps, 40,936 cubic feet: the quantity of gas manufactured in one retort, in six months, being 755,036 cubic feet, from an equal proportion of cannel and other coals. Therefore, my conclusion is that iron retorts are superior to clay ones for small works.

The quantity of gas I manufactured in each month with one iron retort, was as follows:—

	Number of Charges.	Cannel and other Coals. tons.	cwt.	Consumption.
From Sept. 25, 1861, to Oct. 25, 1861	124			
Quantity of cannel and other coals (in each charge. 1½ cwt.)		9	5	
Gas manufactured, first month				91,000
From Oct. 25, 1861, to Nov. 25, 1861	182			
Quantity of cannel and other coals (in each charge, 1½ cwt.)		13	13	
Gas manufactured, second month.				139,200
From Nov. 25, 1861, to Dec. 25, 1861	184			
Quantity of cannel and other coal (in each charge, 1¾ cwt.)		15	5½	
Gas manufactured, third month				159,168
From Dec. 25, 1861, to Jan. 25, 1862	184			
Quantity of cannel and other coals (in each charge, 1¾ cwt.)		15	2	
Gas manufactured, fourth month.				150,400
From Jan. 25, 1862, to Feb. 25, 1862	186			
Quantity of cannel and other coals (in each charge, 1½ cwt.)		13	10	
Gas manufactured, fifth month				129,300
From Feb. 25, 1862, to March 25, 1862.	137			
Quantity of cannel and other coal (in each charge, 1¼ cwt.)		8	12½	
Gas manufactured, sixth month				85,968
Total consumption	999	75	8	755,036

The conclusion I, of course, naturally come to—and every man who understands the manufacturing of gas will agree with me—is, that it would be a great loss to me were I to use clay retorts instead of iron retorts; and I further beg to say that, in the above statement, I have not allowed for the quantity of gas that has escaped or has been condensed in mains 1½ mile long, and 171 service-pipes, because the Commissioners here have not placed a station-meter. This iron retort, I may add, may have acted much better, in consequence of my having placed it up upon a new system of my own, which I find answers very well, and saves much more fuel than before.

Bethesda Gas-Works, North Wales. JOHN TAYLOR.

A NATIONAL REPROACH.

SIR,—It is lamentable that genius is so often neglected and discarded during the life of the individual, but this is sometimes atoned for after death, by the appreciation of departed talent.

To the late Samuel Clegg, is due the honour of *establishing* gas lighting; but for him it probably would have been retarded many years, and but for him only a small portion of the enormous capital profitably invested therein would have been employed, and only a small portion of those who now reap a rich harvest by gas lighting would have profited.

It is to be regretted that the laudable example of the JOURNAL OF GAS LIGHTING, to obtain a competency for the widow of the late S. Clegg, should have met with such slight success; for, on reference to the list of subscriptions, I find that out of upwards of *one thousand* gas companies established in the United Kingdom, only thirty-four have given anything, and of the thousands and tens of thousands directly or indirectly employed in gas lighting, only seventy-seven have contributed to the aid of the widow of the man who combated all the early difficulties, and who was the preceptor alike for gas companies and those in their employ.

I hope you will not yet abandon the good work you have commenced, and, I trust, those engaged in the business will awake to a sense of their duty—that they will understand how much they are indebted to that genius—and make a slight acknowledgment of the same, by contributing to the fund to soothe the declining years of the widow. A. B.

London, May 30, 1862.

IMPROVED BLADDER-VALVE.

SIR,—As a remedy against a repetition of such an accident as that which lately occurred from an explosion of gas in Holborn, I beg to suggest the use of the ordinary pressure-gauge, constructed as shown by the following sketch. Quicksilver being used instead of water, the square boxes at the top of the gauge will prevent the escape of the quicksilver, if driven up by any sudden expansion or contraction produced by increased temperature or otherwise.

When the bladder is inflated by means of the cock inserted in the pipe connecting it with the pressure-gauge, the column of mercury will be raised to the required height, indicating the pressure within the bladder.

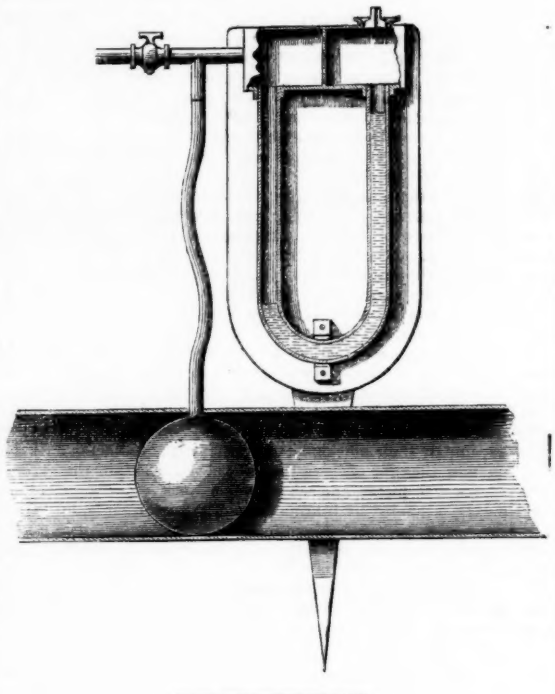
I would advise that a man be employed to watch the instrument, so as to be able to detect at once any fall in the mercury consequent upon a leak in the bladder.

Attached to the gauge is a spike, for the purpose of fixing it in the ground.

If you think the above worth a place in your valuable JOURNAL, I shall be obliged by its insertion.

G. GOLDSMITH.

Leicester, May 28, 1862.



IGNITION OF GAS.

SIR,—I have been much edified by the very lucid article of Dr. Frankland, in your last impression, on the "Igniting Point of Coal-Gas;" but, as laboratory experiments, and practical observations often differ in their results so as to puzzle one as to the cause of such differences, I think the following fact may, perhaps, not be altogether unacceptable to you.

Very recently, one of our men in excavating for the purpose of laying a service, all of a sudden noticed a small explosion, and, at the same moment, found himself enveloped in flame: the road was very hard, and had again and again been macadamized with flints. Previous to the explosion, his pickaxe was continually striking against these flints, and extracting sparks, until the above phenomenon happened and stopped him from his work.

Being suspicious that a leak of gas, unsuspected until then, was near at hand, he began to search for the same; and, immediately under his feet, but some considerable distance deeper down, he found the main sunk, and a leak at one of the sockets, which had caused the escape of gas, and the consequent explosion.

I made the most particular inquiry, and am quite satisfied that no fire of any description, nor even a "plumber's iron," was anywhere near the spot, and, I have no doubt, that after breaking through the solid crust of the hard-faced road (which had until then kept the gas enclosed), and so letting loose a portion of the captive gas, it was then ignited by the sparks thrown off from the labourer's pick, and produced the phenomenon which might, in other cases, have proved serious.

I cannot help thinking that the doctrine of the "non-ignition of gas by sparks," as your correspondent, "C. B. F." terms it, is very indefinite. Sparks may be of different temperatures, from a dull red, to a brilliant white; the gas also may be of different temperatures, and of varying constituents; therefore, while coal-gas might

not ignite with sparks in one case, it might do so in another. I have repeatedly exploded it with a common flint and steel by slightly raising its temperature previously; and we must recollect that the stroke of a workman who is throwing all the strength of his arms into the stroke of his pick against a hardened flint road, will throw off sparks of a much higher temperature than one will do with a kind of comparatively toy flint and steel in a laboratory, and, in the case I have quoted, did do so quite sufficient to ignite the gas.

I trust these facts will not be without their moral, but will make us still more cautious in all our dealings with so subtle an article, as we have had so many proofs of late how harsh a master it is when it gets the upper hand. A. H. Wood.

Gas Company's Office, Hastings, May 28, 1862.

Register of New Patents.

[*The length of the report of the important patent case of* Smith v. the New River Company, *obliges us to postpone our usual abstract of the specifications of recent patents.*]

APPLICATIONS FOR LETTERS PATENT.

1496.—Christopher Binks, of Parliament Street, Westminster, London, S.W., for "*Improved methods of obtaining oxygen and chlorine gases.*" May 17, 1862.

1516.—Timothy Morris, Robert Weare, and Edward Henry Cradock Monckton, of 4, Trafalgar Square, Charing Cross, London, W.C., for "*Improvements in obtaining, and applying light and heat by electricity.*" May 19, 1862.

1523.—James Taylor, of 13, Fenchurch Buildings, Fenchurch Street, London, E.C., for "*Improvements in abstracting heat from liquids and aëriform fluids, and for other purposes.*" May 20, 1862.

1525.—Edward Fewtrell, of Birmingham, Warwickshire, engine-fitter, for "*Improvements in the manufacture of metal tubes, and in machinery to be employed for that purpose.*" May 20, 1862.

1533.—Macedo Alexandre Le Brun Virloy, of No. 9, Rue Sigalle, Paris, civil engineer, for "*Improvements in drying and carbonizing wood, peat, and other fuel.*" May 21, 1862.

1551.—William Roberts and Thomas Greenacre, of Millwall, London, E., for "*Improvements in cocks or valves for steam or other fluids.*', May 22, 1862.

1564.—George Thomas Livesey, of the South Metropolitan Gas-Works, Old Kent Road, London, S.E., for "*Improvements in purifying illuminating gas, and in treating the products obtained in the various processes of purification.*" May 26, 1862.

1574.—Jean André Cecile Nestor Delpech, of Castres, France, manufacturer of engines and machinery, for "*Improvements in pumps.*" May 26, 1862.

1580.—Thomas Dutton Templer Sparrow, of Piccadilly, London, W., brush-maker, for "*An arrangement or arrangements for shading street-lights, in order to protect or shade the eyes of riders and foot passengers from the dazzling effects of the flames of such lights.*" May 26, 1862.

1602.—Ralph Martindale, of Birmingham, Warwickshire, lamp-manufacturer, for "*Improvements in the manufacture of globes and glasses, more particularly applicable to hydrocarbon and spirit-lamps, and also in fastenings for securing the globes or glasses in those and other descriptions of lamps.*" May 28, 1862.

1617.—Charles Denton Abel, of No. 20, Southampton Buildings, Chancery Lane, London, W.C., patent-agent, for "*Improvements in apparatus for raising, propelling, or exhausting air, water, or other fluids or gases.*" A communication. May 29, 1862.

GRANTS OF PROVISIONAL PROTECTION.

1001.—Howard Ashton Holden, of Birmingham, Warwickshire, merchant, and Charles Weekes, of Carmarthen, S. Wales, civil engineer, for "*Improvements in apparatus used in drawing water or other fluids from cisterns, tanks, or other vessels.*" April 8, 1862.

1285.—William Edward Newton, of 66, Chancery Lane, London, W.C., civil engineer, for "*Improvements in lamps.*" A communication. April 30, 1862.

1289.—Charles Pierre Alexandre Douchain, of St. Cloud, France, ingénieur, for "*Improvements in apparatus for letting in or shutting off water or other liquids.*" May 1, 1862.

1311.—Jean Marie Herdevin and Joseph Alexandre Jullien, ingénieurs, of 13, Rue Gaillon, Paris, for "*Improvements in sluice-cocks.*" May 3, 1862.

1385.—Leo De La Peyrouse, of 13, Panton Square, Haymarket, London, W., manufacturer, for "*Improvements in treating neutral and acid, fatty, or oily substances, resins and resinous substances, and compounds or products containing paraffin.*" May 8, 1862.

1404.—Robert Moore, of Cannon Street West, London, E.C., engineer, for "*Improved apparatus for indicating the presence, position, or accumulation of liquids, gases, or vapours, and apparatus for preventing danger or damage consequent thereon.*" May 10, 1862.

1414.—Henry William Sambridge, of Birmingham, Warwick, for "*Improvements in sliding chandeliers, gaseliers, and other pendent lamps.*" May 10, 1862.

1496.—Christopher Binks, of Parliament Street, Westminster, London, S.W., for "*Improved methods of obtaining oxygen and chlorine gases.*" May 17, 1862.

NOTICES TO PROCEED.

109.—Christopher Hill, of Ferryside, Kidwelly, Carmarthen, South Wales, coal-agent, for "*Improvements in the manufacture of lubricating compounds.*" Jan. 14, 1862.

113.—William Cleland, of 39, St. George's Hill, Everton, Liverpool, Lancashire, for "*Improvements in treating and utilizing certain materials used and products obtained in the manufacture of gas, and in apparatus connected with the said treatment.*" Jan. 15, 1862.

136.—William Tice, of 16, Downham Road, Islington, London, N., for "*Improvements in gas-regulators and meters, part of which invention is also applicable for covering various descriptions of metal spindles.*" Jan. 18, 1862.

246.—Edward Alexandre Rippingille, of Staple Hill, near Bristol, for "*Improvements in engines worked by steam or other fluid, and in pumps.*" Jan. 30, 1862.

261.—John Hargreaves, of 12, Clifton Cottages, Clifton Road, Peckham, London, S., for "*Improvements in the manufacture of pipes or tubes conveying water, gas, acids, sewage, enclosing telegraph-wires, and for other purposes, which improvements are also applicable to the manufacture of other vessels and articles, and in the machinery or apparatus connected therewith.*" Jan. 31, 1862.

484.—Marc Antoine François Mennons, of 38, Rue de l'Echiquier, Paris, for "*Improvements in burners for heating by gas.*" A communication. Feb. 22, 1862.

485.—William Johnston, of Glasgow, N.B., metal merchant, for "*Improvements in gas, and other lamps and stoves.*" Feb. 24, 1862.

606.—Thomas Hack, of the West Middlesex Water-Works, Hammersmith, London, W., and Alfred Edwin Carter, of the West Middlesex Water-Works, Kensington, London, W., for "*Improvements in screw-cocks.*" March 6, 1862.

1040.—James Thomas Grice, of Birmingham, Warwickshire, tube-maker, for "*Improvements in the manufacture of twisted metallic tubes.*" April 11, 1862.

1164.—James Chapman Amos, of The Grove, Southwark, London, S.E., engineer, for "*An improved mode of, and improvements in, apparatus for supplying surface-condensers with water, part of which improvements is applicable to blowers and rotary pumps generally.*" April 21, 1862.

1248.—James Eglinton Anderson Gwynne, of Essex Street Wharves, Strand, London, W.C., engineer, for "*Improvements in the construction of centrifugal pumps, and in the application thereof, parts of which improvements are also applicable to other pumps.*" April 29, 1862.

1304.—Alfred Vincent Newton, of 66, Chancery Lane, London, W.C., mechanical draughtsman, for "*Improved electrical apparatus, applicable to the lighting of gas.*" A communication. May 2, 1862.

Parliamentary Intelligence.

HOUSE OF LORDS.

Monday, May 19, 1862.

The Barnsley Local Board of Health Bill was returned from the Commons, with the amendment agreed to.

The Leeds New Gas Bill was returned from the Commons, agreed to.

The Bristol Water Bill was returned from the Commons, agreed to, with amendments, and the said amendments considered and agreed to.

Tuesday, May 20.

The Falmouth Water Bill was returned from the Commons, agreed to.

Friday, May 23.

The Bollington (Prestbury) Improvement and Lighting Bill was returned from the Commons, with the amendments agreed to.

Monday, May 26.

The Dundee Water and the Kent Water Bills were returned from the Commons, agreed to.

Friday, May 30.

The Liverpool Corporation Water Bill was brought from the Commons, read a first time, and referred to the Examiners.

The Leeds Water Bill was returned from the Commons, agreed to, with amendments, and the said amendments were considered and agreed to.

HOUSE OF COMMONS.

Monday, May 19, 1862.

The Falmouth Water Bill was read a third time, and passed.

The Reading and Reading Union Gas Company, the Wakefield Water, and the Windermere District Gas Bills, were read a second time, and committed.

Parochial Assessments Bill.—A petition against the Bill was presented from the Bury and Ratcliffe Water-Works Company.

Tuesday, May 20.

The Kent Water and the Dundee Water Bills were reported, without amendment, and ordered to be read a third time.

The Stretford Gas Bill was read a second time, and committed.

POLICE AND IMPROVEMENT (SCOTLAND) Bill.—A petition against the Bill was presented.

PAROCHIAL ASSESSMENTS Bill.—A petition against the Bill was presented.

THURSDAY, MAY 22.

The BOLLINGTON (PRESTBURY) IMPROVEMENT AND LIGHTING Bill.—The Lords amendments were agreed to.

PAROCHIAL ASSESSMENTS Bill.—A petition against the Bill was presented.

FRIDAY, MAY 23.

POLICE AND IMPROVEMENT (SCOTLAND) Bill was considered in committee and reported, and recommitted for Monday, the 26th inst.

The DUNDEE WATER and the KENT WATER Bills were read a third time, and passed.

Two petitions were presented against the HIGHWAYS Bill.

PAROCHIAL ASSESSMENTS Bill.—Two petitions against the Bill were presented.

MONDAY, MAY 26.

The LEEDS WATER Bill, as amended, was considered, and ordered to be read a third time.

A petition was presented against the HIGHWAYS Bill.

The HIGHWAYS Bill was considered in committee.

TUESDAY, MAY 27.

The KENT COUNTY GAOL AND LUNATIC ASYLUM (WATER SUPPLY) Bill was reported.

The LIVERPOOL CORPORATION WATER Bill was read a third time, and passed.

The ABERDEEN POLICE, WATER, &c., Bill, was recommitted to the former committee.

PAROCHIAL ASSESSMENTS Bill.—A petition against the Bill was presented.

WEDNESDAY, MAY 28.

PAROCHIAL ASSESSMENTS Bill.—Petitions against the Bill were presented from the Croydon Gas Company and the Dudley Gas Company.

THURSDAY, MAY 29.

The LEEDS WATER Bill was read a third time, and passed, with amendments.

A petition was presented against the HIGHWAYS Bill.

PAROCHIAL ASSESSMENTS Bill.—A petition against the Bill was presented.

The HIGHWAYS Bill, as amended, was considered, a clause added, amendments made, and the Bill ordered to be read a third time.

FRIDAY, MAY 30.

PAROCHIAL ASSESSMENTS Bill.—A petition against the Bill was presented.

HOUSE OF COMMONS.

UTILIZATION OF SEWAGE OF TOWNS.

(*Continued from page* 333.)

MONDAY, MAY 19.

Mr. *Benson*, examined by the CHAIRMAN.

I am an agent of the Duke of Bedford, at Tavistock. The sewage of that town is conveyed on to the land below by gravitation. The drainage extends nearly over the whole town, and falls into one channel or stream, a mill which existed upon that stream having been removed for the purpose. There are 95 acres of land treated with the sewage, and they are laid out in the ordinary way for water-meadows. The sewage is conveyed by a brick culvert, 4 feet by 2½, of an oval shape, and covered to the point of outfall. There is no reservoir there, but the sewage goes into surface-drains. There are no flood-gates till it reaches the first level. There were no houses within a quarter of a mile of the outlet at the time the system was laid down, but it was necessary to carry it so far, in order to pass under a navigable canal, and bring it to the level of the surface. The land to which the sewage is applied, is all grass-land; some of it was formerly in tillage. It was not laid down specially for the purpose. The population from which the drainage is furnished is about 6000. The parish contains nearly 9000 inhabitants, but taking off the rural portion there are about 6000 in the town. I should think the area of rainfall is between 1000 and 2000 acres. There is a very large district above the town, and a stream which ultimately goes into the culvert. The meadows are not let on lease, but to yearly tenants. Hay is made on a portion of them; it has been made on the whole, but I do not think what we have of their present usage would suffice for any public purpose. They are let with the general system of farming. I have no knowledge of the results of the application of sewage to other crops than grass, nor of any other system of applying it than by open carriers. I have no doubt that the use of the grass produced on the land is beneficial to cows; they are very fond of it. At one time, the produce of the meadows was not let; we employed persons to cut it, and we had very good second and third crops. I believe the meadows are in a better condition now than they were then. I do not know how many tons of sewage per acre have been applied. It would be almost impossible to tell, as the quantity varies so much, on account of the springs and the water-shed. There are only about 9 acres more land to which the sewage could be applied. I believe the pure water as it comes in from the springs above the town would do good, if applied to the land.

By Mr. ADDERLEY: There is a water supply at Tavistock. The system of water-closets is getting very general now; I do not think the proportion is half. The grass on the sewaged land might be cut for hay before this time, but the farmers generally rely upon it to keep sheep upon in the spring, and they then mow the subsequent crop. No other manure is put upon the land. A great deal of it, before the system of irrigation commenced, was very poor land, worth probably from 10s. to 15s. an acre. Now, I should think, the land if offered to be let would be worth £3 an acre. As grass-land, any ordinary tenant would be glad to have it at £3 with the right of receiving the sewage. Some of it is now let at £5 per acre.

By the CHAIRMAN: If the whole of the 95 acres were offered to be let for a tenant to do what he pleased with them, having the use of the sewage, we might get £6 an acre rent. It is now only let to two tenants. The upper 20 acres are let to one farmer, who has found the system very beneficial. At one time, he made two crops of hay upon them; he now grows his hay at home, and grazes this land with fat cattle.

By Sir B. LEIGHTON: The cost of laying out the land for irrigation was about £13 per acre; that was for levelling, draining, and putting it into proper form, but not including the cost of the sewer. The whole was done by the Duke of Bedford. The whole cost of the sewer, from time to time, has been £1590. The pipe-drainage the tenants do themselves.

By Mr. AYRTON: The cost of removing the mill is not included in either of these two sums, because I consider that was a general benefit to the town. It was necessary to take the mill down, and to remove the mill-race, in order to utilize the sewage, on account of the levels; but it was desirable also on other accounts. It was a public nuisance, and the buildings were very old, so that I never considered the cost of its removal should be added to the cost of utilizing the sewage. The tenant built the mill, and pays a ground-rent equivalent to what the old mill was let for.

By Mr. ADDERLEY: The Duke of Bedford had no other interest but his own to consult, in laying out the sewage-works. If the mill had belonged to some one else, no doubt there would have been some compensation to pay. The cost of going under the canal is included in the figures I have given. The cutting was 17 feet deep. The tenants put the pipes from the water-courses to their premises. As a money question, it has been profitable to the duke, and I think it may be made much more profitable. Excepting the first 20 acres, the whole of the land had been in the hands of the same family for a long time previously.

By Mr. PAGET: The sewage is sometimes allowed to run away, because they cannot put it upon land they are grazing. I am not satisfied that the most is done with it that could be. I would cut a large portion of the grass green, and always have fresh land to put the sewage on as it comes. We cannot apply it to a larger area without mechanical power. One of the tenants has made a collecting-tank, but I have no idea that he gets any benefit from it. There is a nuisance, on a foggy day, to the persons living a quarter of a mile off, when the sewage is applied—the same sort of nuisance that there is from a recently-manured field within the same distance. I think that the further it is kept from houses the better; it is offensive, but I do not think it is deleterious. There have been no bad sanitary effects, and persons are building houses near the fields at the present time. I do not know what the water supply at Tavistock is; we have not so much water as we ought to have for domestic purposes.

By Mr. BLENCOWE: Some of the houses near the culvert have been built by the duke, and some by the tenants. The greater part of the town belongs to the duke. The sewaged land has not been let as accommodation land, but as portions of the farms in the neighbourhood.

By Colonel FANE: Some portion of the land has been drained. The soil varies exceedingly. There is some very good loam soil; there is also some heavy clay and some poor sand. I think the per centage of advantage is as great upon the sand as anywhere. The tenants now pay all the expenses. I do not think that any repairs have had to be done. We got £10 for the first cutting off the land. I do not know that we tested it afterwards, as we were satisfied that the increase was large. We have used the sewage for fifteen years.

By Mr. AYRTON: We do not find that there is any injury to the fish in the stream from the water which drains from the meadows. It is a trout and salmon stream.

By Mr. ADDERLEY: It is impossible to say what quantity of sewage the land would take. I have seen a great many water-meadows. No doubt to some extent the irrigation with pure water is good, but I should think the sewage irrigation is much better. It does have the effect of making the crops rank, but you may always cure that by frequent cutting. I have not compared the results of the application of liquid guano and liquid sewage. I apprehend you might get larger crops with the one or the other according to the quality you employ. I do not think we have any knowledge as to what the strength of our sewage is. The fall in some parts of the town is very considerable, but I have never known the culvert to be choked up. Within certain limits we can flood any portion of the 95 acres we please. I do not consider that the solid deposit is worth much as manure, compared with the liquid. The first 20 acres of land, which are now let for £5 an acre, was formerly let at 40s. That is the only portion which has been relet since the irrigation commenced. The tenant who has the other 75 acres has all the advantage of the sewage without any extra charge. If the farms were relet next year, the increase in value would be found to be very great. Since I have been the duke's agent, there have been many acres of land irrigated with pure water, but the rent has not been increased in consequence. It would be very hard upon the farmer that his rent should be raised upon him on account of the water running through his farm being applied to it. The interest of the outlay is all that the landlord ought to seek for it. The outlay for irrigating with pure water or sewage is not the same, because much of the pure water irrigation is by the catch-meadow system, and you cannot always do that with sewage.

By Sir B. LEIGHTON: I have no doubt that for all the cost of the sewers and the irrigation the duke could, if he chose, get more than 10 per cent. on the outlay. He does not now get it, but the land is gradually growing into an improved state. The improvement upon the poor hungry sand has been slow, but some of it is getting into a good state.

By Mr. PAGET: The town is on a slope. There are some irrigated meadows with a fall of only two or three inches a mile. Some of our sewers only slope six inches in 200 feet. We get as near the level as we can to secure a fall. It is essential the water should be kept moving. There are some large steers kept upon the land now. No Devonshire grazier thinks of using cake upon grazing land.

By the CHAIRMAN: I can hardly say how many more acres of land the sewage of Tavistock would supply. I do not think it is necessary or desirable always to apply a great deal of sewage to land. Unless you cut the grass for use green, it is not at all desirable that you should make it over rich. I think a lesser quantity frequently applied is better than a larger quantity in a given time. It would be the preferable plan to have such arrangements as that the sewage could be turned on when you like. I cannot say practically that liquid sewage is more valuable than solid, but I believe it is. If the surrounding farmers had the opportunity, I have no doubt they would take the sewage; but I think it would be a long time before you would get them to understand the value they ought to give for it, though they would be inclined to give it a trial. If they once tried it, I am sure they would never give it up again. If brought into the market, I should say sewage would become a marketable commodity.

By Mr. ADDERLEY: I cannot tell the comparative value of irrigated hay and upland hay.

By Mr. BLENCOWE: The cost of sewage application would vary so much according to circumstances that I do not know whether it would always pay 5 per cent. upon the outlay; but the benefit is so great, that I have no doubt

it would pay much more if you could take the sewage of a town and apply it independently of all the obstructions from different ownerships.

The CHAIRMAN: Do you think it advisable that powers should be given by Parliament either to corporate bodies or other persons to convey sewage over land, and distribute it at a distance?

Witness: I think it would be highly desirable that they should have power to do it.

Mr. *McCann*, examined by the CHAIRMAN.

I am a builder and farmer at Malvern, Worcestershire. I cultivate about 500 acres, and employ, in so doing, the sewage of the town of Malvern. At the time I first took the land its condition was very bad, and very little had been done to it in the way of drainage. The crops I grow are of almost every description—wheat, barley, beans, peas, swedes, mangel-wurzel, carrots, kohl-rabi, &c. I apply the town-sewage to about 50 acres of meadow and Italian rye-grass. The sewage of Malvern is very much diluted. If I could have it all of the same quality that it is between nine and eleven o'clock in the morning, which is the time I suppose the housemaid is chiefly at work, it would be very good indeed. The town is pretty generally supplied with water-closets under the provisions of the Malvern Improvement Act of 1851. I have no idea of the quantity of water supplied to the town. It is derived partly from the mills, and partly from wells. The supply is not so good as it is in many places. The rainfall area consists of one side of the Malvern Hills, and is, perhaps, 1000 acres. The number of inhabitants in the town is nearly 7000, but I do not get the sewage of the whole. I cannot tell how many houses drain into my sewer; perhaps rather more than one half of those in the town. If I had the means of applying it, I should like to turn the sewage upon my turnip land. At this time of year, I think it would be advisable to apply it to ploughed land. I consider it would be a proper application to turnips at this time. I have used it to carrots, and swedes, and mangel-wurzel as an experiment, and found the result very satisfactory. The character of the land is very variable—often of different kinds in the same field. The sewage has been applied to the whole, and has been equally productive with all kinds. The fields are so laid out that I can put it on any quarter acre I please. On the first 15 acres I laid out, I have got more than 50 cwt. of grass per acre. The land, before I put the sewage on it, was never fit to be mown. It grew thistles, and gorse, and nettles, and all sorts of weeds. I attribute the whole of the beneficial results which I have obtained, to the use of sewage and under-draining. I laid out £250 for draining, the first year; and £200 a year for the next two years. I shall begin cutting my grass for hay this day week, if the weather is favourable. I have cut as much as 25 cwt. per acre for the second crop. I do not cut a third time, but graze after the second cutting. I put cattle on the land before the first cutting. I had sheep on the land which I intend to mow next week until the middle of April. The number of stock which I can keep upon my farm has greatly increased since I have utilized the town-sewage. I find that it forwards the vegetation very much, and no one in the neighbourhood can cut grass so soon as I can. Cattle have not the slightest objection to eat the sewaged grass. I have seen horses, cows, sheep and pigs, eating, twenty-four hours after the sewage has been applied—indeed, they are very fond of it. The milk produced by my cows is as good as it can be. I keep a great many sheep which are in as good condition as possible. I generally give my sheep oil-cake, or other artificial food, because I get out fat sheep at this time of the year; otherwise, I should not do so. A neighbour of mine uses the sewage, and is satisfied with the result. He mowed the last day in March. The other farmers do not use it. They have hitherto looked upon it as a nuisance, but from what they have seen as to results, they are beginning to fall in with it. I think many of them now would use it. They are trying it after it has passed over my fields, and got into the stream. Of course, it is then filtered to a great extent, but they find much benefit from it. I think if sewage generally were utilized, guano would be very little used at all. I have not used it for the last four or five years. My land, without the sewage, was worth 25s. an acre; but, I have no doubt, if the 147 acres which I have on lease, were to let to-morrow, there would be no difficulty in getting from £3. 15s. to £4 per acre. It would be to the interest of all towns, I think, that sewage should be utilized.

By Sir B. LEIGHTON: I have spent a good deal of money in grubbing up the gorse, and in draining and fencing the land. The cost of laying down carriers for the sewage was about £3 per acre.

By Mr. BLENCOWE: I have applied sewage by hand to carrots, and with good results. My object in making the experiment, was to see whether it would increase their weight. I have no doubt it would pay pecuniarily. I am going to apply the sewage on ploughed land by pipes. The sewage-water is very much discoloured, especially in the morning. I have had no complaints of nuisance, arising from my application of it. The town of Malvern Links is drained into a small stream, which is found to be in a very offensive state.

By Colonel FANE: I consider that my swedes were increased in size one-fourth by the application of sewage to them. I do not like to put it on meadow-land at this time of year; it is always applicable to grass-land. I have 24 cows on a 16-acre field, and they cannot eat it down.

By Mr. ADDERLEY: Before I took the sewage, the town commissioners of Malvern paid a person £50 a year to take it on his land. When that person left his farm, I agreed to take the sewage without any charge. I pay 50s. an acre for land which my predecessor paid 25s. for. The proprietor had in view that the sewage would benefit the farm, and so had I, or should not have given such a price for it. At this time of year, when I cannot use the whole of the sewage, I pass it through a filter, and take out all the solid matters; the liquid is then allowed to flow into the stream. I prefer the liquid to the solid sewage, as it brings the land into a better state, and is more beneficial to the crops. I built two large tanks, in the first instance, but, finding them of no use, I took them up. I think the solid matter would be worth cartage to some little distance—not more than five miles. The commissioners get no return for their sewage, nor for their outlay, except that they have the town well drained.

By Sir B. LEIGHTON: My landlady and myself have spent between us about £1600 for draining, grubbing up, fencing, &c. A large proportion of this expenditure would have been necessary if I had never had the use of the sewage. The cost of getting the sewage on the land has been about £1400, the interest on which would be £70 a year; but, if I were to let my land to-morrow, I should get an additional rental of about £145.

By Mr. BLENCOWE: The reason I discontinued the use of the tanks was, that the solid manure was so mixed up with gravel from the hills, that it was of no use. My neighbour mowed 10 tons of common grass per acre, in the first week of April, upon land where, seven years ago, there would not have been 10 cwt.

By the CHAIRMAN: I consider that there are permanent benefits to land by the application of sewage. When it has become improved, it does not require such large dressings as at first. I should apply sewage like other manures, according to the necessities of the case; I would not keep the land constantly inundated with it. Undoubtedly, the effect of too great an application at one time is to produce very coarse grass. All the tender grass becomes destroyed, if it is not properly managed. I should apply small quantities over a large area, just as required. I have had no fallow upon my land for some years. When the land is fallow, I think a good soaking of sewage would do it good. The quantity I now have would be sufficient for a much larger area.

By Mr. ADDERLEY: If no one could be found to take the sewage of Malvern, the commissioners would have to send it down the brook as they used to do, and destroyed all the fish. I have never known sewage so strong as to burn up the crops; there is always too much water with it.

Mr. *Comport*, examined by the CHAIRMAN.

I am a farmer. I farm 120 acres of land in the neighbourhood of Chatham, upon which I have been using the night-soil from the town for the last thirteen years. There are other farmers in the locality who use it as extensively as I do. I have experimented with it upon almost every crop; I consider that it does not do for corn at all. I have used it to grass, but not much. I have applied it upon arable land to all sorts of crops.

Colonel FANE: This has nothing to do with sewage; everybody, I suppose, has used night-soil.

The CHAIRMAN: This is a witness that Sir Frederic Smith wished to have examined. Is the sewage you employ in a fluid state?

Witness: That depends upon the condition in which I get it. I do not mix water with it. If it comes from where the subsoil is chalk, it is much more in a solid state than when obtained from the clay soil. It is conveyed to the farm in waggons. At times, we mix it with other manures or earth. When mixed with the sweepings from the London streets, it is the best manure we can get. I use very little artificial manure indeed. I have fond that it has improved my land. It has enabled us to produce much larger crops of grass; but I find the greatest benefit in putting it on the root-crops—mangel-wurzel and potatoes. I believe it has a greater effect upon rye-grass than upon anything else; but I have not so applied it. I have no turnips on my land. We measure the night-soil by yards. A common night-waggon holds 4 square yards, and we consider that one load, which is about 4 tons, is sufficient for a quarter of an acre. There is certainly a very strong smell with it, but it goes off soon. I do not think the smell is so bad as that of fish manure.

By Mr. PAGET: It is perfectly pure night-soil we get: there are no ashes in it. The farmers generally pay 7s. for a waggon load. I do not know what arrangement is made between the nightmen, who convey it to us, and the proprietors of the houses. I think about 10s. is paid by the inhabitant of a house who requires his privy to be emptied.

By Sir B. LEIGHTON: I have used guano at £13 per ton to the extent of 3 cwt. per acre; but I do not think it is equal to night-soil in its effects. I would rather have 16 yards of night-soil, for which I should pay 28s., and which to put on the land would cost me altogether £2. 16s., to half a ton of guano. My farm is about half a mile from Chatham. There is no difficulty in getting rid of this manure. Horse manure varies from £5 to £10 a barge load at Chatham. I have all the manure from Brompton Barracks, and pay 6d. per horse per week for it, which is about 3s. 6d. per square yard. I take the contract from the contractor who supplies the forage. I have had it from 3d. to 6d.; I never gave more than 6d. The land is on the chalk, and there is rather a thin soil, which requires considerable manuring.

Colonel FANE: I have several farms near London upon which night-soil is employed; but, in all my experience, I never saw it used in its natural state. Do not you ever mix it with dirt and lime?

Witness: Yes, frequently; but I would rather put it on as it is. The night-soil is applied by hand and bucket.

By Mr. BLENCOWE: At Chatham, the privies are sometimes not emptied for ten or eleven years. We are so situated that we cannot dilute the sewage.

The room was then cleared; and the committee remained in consultation until the close of their sitting.

THURSDAY, MAY 22.

Philips Miles, Esq., examined by the CHAIRMAN.

I was formerly a member of this House. I am the proprietor of an estate near Bristol, containing 210 acres. When I first took possession of that estate, my attention was called to the question of the utilization of the sewage, there being at that time no main drainage; and, in hot weather, the smell was so offensive that I found it absolutely necessary something should be done. At considerable expense, I made a covered drain; and, having visited Scotland and other places where the sewage was being utilized, I determined to spend a little more money, and make use of the refuse of my estate. Upon the average of the year, there are about thirty inhabitants in my house. I apply the sewage chiefly to grass. I have laid down iron pipes, and apply it by hose and jet to about 12 acres of ordinary meadow-grass, and about 2 acres of ploughed land. One field I always feed, and the other I mow every year regularly one crop. Latterly, I have been feeding alternately with ewes and lambs, and then taking a crop of grass afterwards. My land is more capable of feeding cattle now than formerly. I think I may say the principal result is this, that when cows are turned out in these fields, there is a marked improvement in the quantity and richness of the cream they produce. I believe sewaged grass is good for fattening cattle. The vegetation of the sewaged fields is earlier than that of the adjoining ones—certainly, the grass is a month earlier. My farm was worth, when I took it, about 55s. an acre, and I have no doubt I should have to pay double that rent if I took it now. Sometimes I mow the 3-acre field twice—once in the middle of April, after which it is watered; and I then have another crop at the ordinary time. I feed my stock with the first cutting always. The grass is very heavy, but I cannot give an idea of the weight per acre; it is considerably over that of the ordinary grass. I recollect one year cutting sixteen large waggon loads, which would be about 2 tons per acre; and it is very rare not to cut one and a half ton per acre. On 2 acres—part of the 12-acre field—which I have ploughed, I have grown rye-grass, and vetches, and green crops generally. The rye-grass I cut five or six times a year. I have grown vetches, and had a good crop of swedes afterwards. I put in some manure, but I water the swedes with sewage, which brings them up very rapidly. I well drench the manure heap with sewage before I use it on the farm, and I find that it is improved in that way. I think it very desirable to mix sewage with other manure. The experiments which I have made with rye-grass bear out what I have seen at Alderman Mechi's. On the principle that you are able to have two or three crops a year off sewaged land, I should say that the value of the ploughed land is doubled. I do not know that I should quite prefer house-sewage to farm-yard manure, but, in its present state, I should think my sewage is the stronger of the two.

The CHAIRMAN: Can you give the committee any idea of the value of the sewage of the thirty persons?

Witness: I can only repeat the answer I have already given, that, as over a certain portion of my land where I have used it, I consider the land is

doubled in value; therefore, with that view, I should think it is worth £25 or £30 a year to me.

The CHAIRMAN: You have heard that there is an experiment going on at Rugby under a royal commission?

Witness: I have.

The CHAIRMAN: I will state to you what has been done there. A number of acres of grass-land have been treated with sewage. In one portion, 3000 tons per acre per annum, in another 6000 tons, and in another 9000 tons per acre, have been applied. The sewage was not applied by hose and jet, but allowed to flow over open gutters. The grass was cut and used for cows, and the milk sold at 8d. per gallon. The result was, that something over 1d. was all the profit that could be shown for each ton of sewage applied. Can you account in any way for the very unsatisfactory result?

Witness: From my experience, I cannot account for it at all. The only way in which I can account for it, is by supposing that there was considerable waste. If the land is very porous and drained, a great portion of the sewage may, if put on in excess, run away.

The CHAIRMAN: Then, you do not think it necessary to apply a very large dressing of sewage to land?

Witness: I would not say that; I have not the means of applying a large quantity, and, therefore, I cannot give an opinion upon it.

The CHAIRMAN: We were told by Mr. Lawes, that he considered the excrement of a human being was only worth 21s. per annum. Now, from your experience, do you consider that is a fair price?

Witness: If my statements are right, it seems that I do not agree with Mr. Lawes. I have read accounts—I do not know how far they are correct—that it is far more valuable; but, I am not here to say that my actual experiments are correct.

Examination continued: I do not think I should like to have my whole farm under sewage. There is a comfort in walking over the farm now, which there would not be if it were sewaged. I do not find any practical inconvenience from the smell, but you can perceive it a field or two off when it has been applied; but, it is astonishing how soon the smell goes off, and how soon afterwards cattle will feed on the grass.

By Mr. PAGET: I have been applying sewage for ten or twelve years. The cost of the application was £5 an acre. There is nothing but the excreta of the thirty persons, and the washings of the house, roofs, &c.; the farm-yard manure does not go into it. When I commenced, there was a smell from the small closed tank that I erected, but I ran up a tall shaft from it to the top of the house, and now there is no inconvenience experienced. The nature of the soil of my farm is magnesian limestone upon the magnesian rock. I apply the sewage as often as I have got it. The tank will hold 6000 or 7000 gallons. In very wet weather, I have known it to be filled in three or four days; in dry weather, it takes a fortnight. It averages perhaps a week to fill. There are water-closets all through the house.

By Sir B. LEIGHTON: We have only a very limited water supply, my house being on the top of a hill. All my irrigation is by gravitation. I cannot tell exactly the expense of irrigating the land. One man can let out the whole tank in a day.

By Mr. DOULTON: At first, I was very particular as to the precautions taken in the mode and time of applying the sewage, but I find that, except when the wind sets towards the house, if the sewage is let out on the lower field, it is not at all offensive. The lower field, I should think, is a quarter of a mile off. I do not think the sewage from my house is quite sufficient for the 14 acres. I should like to have more, and I should like to have the means of regulating it; because, in wet weather, when I least want it, I have got the most. I have never had a crop of grass cut twice for hay; it has answered my purpose better to feed it. The quantity of hay is not greater than I should obtain under ordinary circumstances, but it is more certain. In a dry year, I have the same crop as in a wet one—that is all the difference I find.

By Mr. CAIRD: I have no idea of the number of gallons, or tons, of sewage applied per acre. I should think all parts of the 14 acres got one dressing in the season—whether a good one or not. I do not know how long it takes to dress an acre. I have never thought it worth while to enquire.

Mr. CAIRD: Well, then, we cannot place much reliance upon your evidence.

The CHAIRMAN: But there can be no doubt of the increased value of the land—from 55s. to £5?

Witness: None.

Mr. CAIRD: Do you think that that increased value is wholly to be attributed to the application of sewage to the 14 acres?

Witness: I do not know what else it is to be applied to.

Mr. CAIRD: You say that the land produces 1½ ton. Do you suppose that land producing 1½ ton per acre is worth £5.

Witness: I get a crop of grass in the spring before the hay, and my after-crop is very good. I have never applied other manure till this year, and now I put it in the corners of the fields where the sewage does not go.

By Sir F. SMITH: I apply sewage to the Italian rye-grass, or the green crops when put in or just coming up, in August or September, and I then do not feed it again till February.

By the CHAIRMAN: I observed that in the corners of the fields where the sewage did not go there was very little grass, and to remedy that I have applied manure. When the application was made to me to give evidence, I put certain questions before my bailiff, who is a practical man, and he gave me the answers which the chairman has.

The CHAIRMAN: Would you wish to put them in?

Witness: I have no wish about it; it is just as the committee please. I would only say I am borne out in my statements by those answers.

Mr. *Westwood*, examined by the CHAIRMAN.

I have been a farmer, and for a considerable time have devoted attention to agricultural pursuits. I was at one time farm bailiff at the North Surrey Schools at Annerley, where there were about 40 acres of land under cultivation. The soil there is a stiff clay. It is very poor soil; so poor, that the tenant who occupied it before it was purchased by the trustees of the school, only paid 15s. an acre. Taking into account the facilities which its situation affords for supplying produce to the London market, I should say the land is now worth £4 an acre. The land was drained at the expense of the school authorities, but I do not know the expense per acre. Some portion was drained at a depth of only 2 feet, and others at 4 feet. There are 16 acres dressed with sewage—12 acres of ordinary meadow-grass and 4 acres of Italian rye-grass. We occasionally tried it with garden-crops and some portion of the root-crops, but I do not see much difference produced in them. There are about 700 inhabitants in the establishment. The sewage was originally passed into a brook, which was nearly dry during the summer. We have now tanks constructed to facilitate its use. One tank which I constructed will hold about 12,000 gallons, and is filled in twenty-four hours, in ordinary weather; in wet weather, it is full in three or four hours. The sewage is constantly flowing, when not required for the Italian rye-grass, over the meadow-land. I should have applied it to more than 16 acres if I had had facilities for doing it, such as the use of a force-pump and steam-engine. On 14 acres, I can apply it by gravitation; on the other two, we have a pump, which we use the boys labour to work, and distribute the sewage by jet and hose. After it has passed over the land, the sewage is filtered in a tank, with charcoal and peat-ashes, before it is allowed to flow into the brook, or we should get complained of. There are water-closets throughout the building for the inmates, and the water supply to the establishment is very good. The whole of the rainfall of the yards is mixed with the sewage, but not that from the roofs. The accounts of the establishment are under supervision, and the balance of profit and loss on the farm is struck every six months. I have made out some calculations—[handed in]—showing the grounds upon which I come to the conclusion that the land has increased in value from 15s. to £5 per acre. From the year 1851 to 1857, nearly 4 acres of rye-grass were irrigated with the sewage of the establishment. There were 1500 tons per acre applied over 2 acres, which are equal to 24 cwt. of guano upon each.

Mr. CAIRD: How do you make out that 1500 tons of sewage are equal to 24 cwt. of guano?

Witness: I take the calculation from an agricultural work. I may not be right.

Mr CAIRD: It is not proved by any result of your own?

Witness: Certainly not.

Examination continued: Sixteen large dairy cows, one bull, three or four head of small stock, and a farm-horse, were kept. Each cow yielded eight quarts of milk per day. There was no perceptible difference in the crop over the whole 4 acres; it was all as thick as it could be. The produce was 70 tons of green food per acre. I believe it is generally agreed that a cow giving full milk will eat 1½ cwt. of green food per day. Allowing 8d. per gallon for the milk, would give £120 for the return from 2 acres, and without deducting the expense of 9d. per ton for every ton of sewage used. Assuming that the sewage had been delivered at 2d. per ton, the landlord or tenant having laid down pipes on the farm for distributing it, then the expenses would stand as follows:—

1500 tons of sewage per acre, at 2d.	£25	0	0
One lad distributing, 12 days	0	12	0
Rent of 2 acres of land, at 25s.	2	10	0
Man's time cutting grass	7	10	0
Part time of horse and cart carrying grass to shed	3	0	0
Interest on outlay	0	16	0
Total	39	8	0

which, taken from £120, would leave £80. 12s. as the net profit upon the 2 acres, supposing there were no other deductions to be made, for keeping stock in the winter time. The other 2 acres were irrigated by open gutters, on the catch-meadow system, and probably received 8000 or 9000 tons of sewage per acre. At least half the sewage of this system was wasted, and flowed off the land. An inspection of the outfall showed that what passed away still retained a large proportion of manurial property, being nearly as high coloured as that which flowed over the surface, while that applied in smaller quantity, with hose and jet, passed away very slowly, and quite clear and colourless. In addition to those 4 acres of Italian rye-grass, the sewage was applied to ordinary meadow, at the rate of 8000 or 9000 tons per acre. The produce was 2½ tons of hay per acre on the two crops. Without the sewage, they yielded not more than ⅔ of a ton per acre. Here, too, most of the sewage was wasted, and was led to the tank to be deodorized with charcoal and peat-ashes. The value of the hay was about 70s. per ton.

Mr. CAIRD: Then £8. 15s. was the value of the produce of these irrigated meadows. How much per ton would that pay for sewage?

Witness: I do not know, without reckoning.

Mr. CAIRD: Something under a farthing a ton—that is the actual result you realize.

The CHAIRMAN: Do you mean to say, that 8000 or 9000 tons of sewage passed over the land?

Witness: I think so; 8000 or 9000, or, very possibly 10,000 tons; it was constantly flowing over; when I did not want it for the rye-grass I passed it over to get rid of it. I do not think it was necessary. I consider it almost a total waste, but I had the sewage, which must be got rid of, and I had to make the best of it. I am quite satisfied that two applications of 300 tons per acre by hose and jet—one in the spring, and the other after the crop of hay—would have given the same result.

Mr. CAIRD: How are you satisfied of that?

Witness: I am satisfied in this way: that the land was never laid down properly for the application of water or sewage. The higher portion of the land did not get anything like the proportion which flowed over the lower part; indeed, I had to get the boys to throw it over with a scoop; and yet I found the same quantity of crop in that as in the remaining portion. I never tried so little as 300 tons per acre.

By the CHAIRMAN: The general effect upon the rest of the land was, that the produce was much more than if farm-yard manure had been applied. In deducing conclusions from these experiments, it may be objected that our sewage was stronger than ordinary town-sewage, but I do not think it was. The establishment consists almost entirely of youths, and, therefore, the excreta must be less stimulating in its character, while the cleanly arrangements enforced must make it more diluted. In reference to the sanitary effect, I may state that the school is under the rigid supervision of the Poor-Law inspectors and the inspector of schools for the district, who would have put a stop to the system if there had been anything injurious in it, the meadows being within 100 yards of the school. With reference to what would be the effect of the application of London sewage——

Mr. CAIRD: We do not want your opinion upon that—we intend to form our own opinion on the subject.

By Mr. BLENCOWE: Before the application of the sewage of the establishment in that way, it all went into the brook; and the Croydon Board of Health threatened us with an action.

By Mr. DOULTON: I had no experience of the land before I applied the sewage. I fix 15s. as the rent per acre from what the previous tenant paid. I have not the means of ascertaining the cost of distributing the sewage, as we used the boys labour. I have no idea of the cost of steam power. There was never any complaint after we began to apply the sewage to the land; there was before, on account of the deposit upon the sides of the brook into which it was poured. There have been no complaints by the residents of houses within 300 yards of nuisances arising from its application to the land. We commenced the operations in 1851, and I left the establishment in 1857. I do not know whether they are still going on; I have not been there since.

Mr. CAIRD: The sewage of 700 persons, applied upon 16 acres, would give 44 persons per acre. Did you hear the evidence of the previous witness, who said that he found the sewage of 30 persons sufficient to go over 14 acres, which is at the rate of about 2 persons per acre?

Witness: I did; but I think he said he would have been glad to have more.

Mr. CAIRD: I have been reckoning that, upon your figures, it would give, as the value of the sewage of each person, 1s. 9d. per annum.

Witness: I have not reckoned it. I should think it is worth more than that, but I have not made the calculation.

The CHAIRMAN: We have had it in evidence to-day that the excrement of 30 persons was worth £25 or £30; therefore, there is a great discrepancy?

Witness: I have said that the great bulk of our sewage ran to waste.

The CHAIRMAN: How many more acres than are now under cultivation do you think might profitably be served with the sewage of Annerley?

Witness: I should think the whole of it might be under grass. I should confine the use of it chiefly to grass.

The CHAIRMAN: You said there were 12,000 gallons of sewage per day, which would be 53 tons.

Witness: Applying that at the rate of 1500 tons per acre, it would take thirty days sewage for 1 acre. It would give, in that proportion, sufficient sewage for 100 acres.

Mr. CAIRD: I think you had better not pursue that.

The CHAIRMAN: It is your opinion that, if the sewage of Annerley were properly applied, it would be capable of fertilizing 100 acres.

Witness: I have not made that calculation.

Mr. CAIRD: The calculation upon this data is, that you would have 19,345 tons in a year, which, at the rate of 1500 tons to the acre, would supply 12 or 13 acres only, and that is not so much as you have laid it on.

Witness: That is for the Italian rye-grass only.

Mr. CAIRD: I think you had better not pursue it further.

By Mr. BLENCOWE: The evidence I am giving relates to the five years from 1851 to 1857. I do not know whether they are now doing it. I would not put more than 600 tons per acre upon meadow-land.

The room was then cleared, and the committee consulted for nearly an hour.

Mr. *Wylie*, examined by the CHAIRMAN.

I am mayor of the city of Coventry. Last year, I persuaded the corporation to employ the sewage upon 11½ acres of their land and 4 acres of my own, which could be supplied by gravitation. The result has been very wonderful. We have nothing but grass—common meadow-grass. My land has been treated more or less with sewage for the last three years; but the corporation land not until the 1st of March this year. I had sewage put on for a month—not all at once, but gave one spot a dressing for a day, and by that means it went over the whole field in thirty days. The man was putting it on for thirty days with a small pipe. I had a carrier put round the highest part of the field, and let the sewage run on the land by its own gravitation. I had two roods of grass cut yesterday; the produce was 9 cwt. or at the rate of 17 tons per acre of green grass. I had previously let the land to a cow-keeper from the 31st of December, and he had fed off every bit of grass as close as he could. I do not know the quantity of sewage put upon the land. If we had had enough land, I should not have put on so much as I did. We have seen it running into the river after passing through the soil, showing that more was put on than required. The corporation have not power to buy land to apply the sewage upon. We hope to see the effect upon our land, as there are many acres to which it might be taken below Coventry, without pumping. We pass our sewage through filter-beds before putting it on the land, and we find, by that means, that it is not so offensive. We take about 1500 tons of deposit out of the sewage every year for which we get 2s. per ton, and we have such a demand for it that we actually now want 500 tons for customers round the town, showing that it is appreciated. I have tried it on my own land, and find that the effect is wonderful. We find that the fertilizing effect of the fluid is wonderful, also. We have two tanks which we fill in about six weeks. Our expense in collecting the solid matter is £3 per week. We intercept 1500 tons per annum. We have 75,000 gallons, or 3350 tons in every twenty-four hours. The sewage of Coventry is, perhaps, better than that of most towns, as we will not pass a plan for a new house without it is provided with a water-closet. As a medical man, I have seen so much evil flowing from those nasty ash-pits that, I think they ought not to be allowed. They are the greatest source of fever, as they poison the water and the air. The corporation had a strong feeling against the utilization of the sewage in this way, and I promised that, if they would grant £20, I would have it done. The total cost for the 11½ acres was £23. 14s., and I have no hesitation in saying that I shall have double the quantity of grass I have had hitherto. I think it is a sufficient application of sewage if you saturate the ground 4 inches deep. The farmers are our customers for the solid manure. They cart it for a distance of three miles, and it is also carried by boats. The solid matter from the tanks is mixed with street-sweepings. The tanks are the property of the corporation. They smell a great deal, but there is so much acid used in the manufactures of Coventry that I do not think they are so offensive as they would be in some places.

By Mr. CAIRD: The whole sewage of the town passes through the filter-beds, and then runs into the river. We do not take the tenth part of it upon the land.

By Mr. PAGET: If we had the power to take the sewage down the county, I think we might double the value of the land to which it could be applied, and that we could do it with advantage to Coventry. No man would be such an idiot, having once used it, as not to use it again. I should always take it, if I could, on low ground; I would never pump it on high ground, for fear it should affect the streams. That would be the only fear. The atmospheric emanations from it are nothing, as the land soons absorbs it. I have put it on land about 400 yards from my own house. It has been two years on 4 acres, and two years upon 1 acre, which I pumped; but I found the expense so great that I discontinued it. The population of Coventry was 42,000 at the last census. There are 2500 water-closets supplied with water from the water-works, but I should think there are about 300 water-closets in all. Where there is but a small quantity of water, the sewage may get decomposed before it reaches the outfall, and that may be the cause why in some places there is a great smell from the use of sewage. If fresh sewage is employed, there is no nuisance.

Mr. CAIRD: You said you were sure it paid when applied to grass; had you any reference to the quantity employed per acre?

Witness: No; I never expected to be asked the question, and I have not made the calculation, but I consider you ought to cover all your land with sewage about 4 inches deep. I have no idea how many tons that would be per acre. I have not reckoned anything for the cost of the sewage itself. I let the corporation carry their sewer through my land for 700 yards, on condition that they should allow me to have the sewage on 20 acres for nothing. I got a valuer to tell me what compensation I ought to have for allowing the sewer to be made through the land, and he said £1150. I think, if I had gone to law, I should have had £500; but I am very much pleased that I have the use of the sewage instead. I have not tried it sufficiently long to know whether I am compensated for it.

By Mr. BLENCOWE: The sewer went through five fields. The damage done by it would be residential damage. I merely mentioned it to show that I appreciated the sewage.

Mr. PAGET: Have you at all thought what powers it would be advisable to give to towns, as to selling land or purchasing it for the purpose of the application of sewage, whether in their own or neighbouring parishes?

Witness: I think they should have power to appoint proper valuers to settle the claims for carrying sewers through lands, and compensate for damage done.

By Mr. CAIRD: If power were given to carry the sewage to the land, I think every enlightened farmer would use it.

By Sir B. LEIGHTON: The tenants of land below Coventry have not asked to take the sewage. We have no power to take it to them. They irrigate their meadows with the river-water after the sewage has got into it, but they would much prefer the sewage itself. I do not think our present arrangements are satisfactory in a sanitary point of view, as far as the river is concerned. Our working expenses at the tanks are £3 per week, and we have sold 1500 tons of sewage; as nearly as possible paying those working expenses. The cost of the sewage works and tanks was £4320, and 6 per cent. for thirty years, or £260 a year, would be about 1¼d. The working expenses consist of taking the stuff out of the tanks, mixing it with the street-sweepings, and carting it away.

By Mr. PAGET: We adopted the Cheltenham plan, which I went to see.

By Sir B. LEIGHTON: We have had no law expenses; we have been threatened with actions. We have bought all the mills. They varied in price from £300 to £700 and £1300. One mill cost us £2200. The last included a long law bill. We bought the mills when the sewer was made through the town, in order to get a better drainage, as they dammed back the sewage.

By the CHAIRMAN: At one time, the question of the precipitation of the sewage was a matter of interest in Coventry, and we had Mr. Austin down; but we found that the precipitating system made it absolutely useless. When sewage is so valuable, why spoil it?

By Sir B. LEIGHTON: When we made the tanks, we expected to sell the solid matter for a great deal. We were obliged to do it to avoid nuisance. I do not think it was a bad outlay.

By Mr. CAIRD: I had a small iron pump, worked by hand, by which I pumped the sewage upon 1 acre; but it was a great inconvenience, and I discontinued it.

MONDAY, MAY 26.

The committee met this day at twelve o'clock, and, after sitting, with closed doors, for about three-quarters of an hour, adjourned.

Legal Intelligence.

COURT OF QUEEN'S BENCH.

GUILDHALL, FEB. 26.

(*Before the Lord Chief Justice* COCKBURN *and a Special Jury.*)

SMITH AND ANOTHER *v.* THE NEW RIVER COMPANY.

This was an action for infringement of the plaintiffs patent of "a new mode of constructing and connecting pipes or tubes for gas, water, or steam purposes." The defendants pleaded "Not guilty;" that the plaintiffs were not the inventors; that the invention was not a new manufacture; that the Queen did not grant letters patent; that specification was not filed; that the invention was not the subject of a patent, and that it was not any improvement, nor in any way beneficial to the public.

Mr. MONTAGUE SMITH, Q.C., Mr. HINDMARCH, Q.C., and Mr. M'CROBY, appeared for the plaintiffs; and Mr. BOVILL, Q.C., and Mr. WEBSTER, for the defendants.

Mr. M. SMITH, in opening the case, said, the plaintiffs, Messrs. Smith and Phillips, were gas engineers, and the patent the infringement of which was charged upon the defendants, was granted on the 26th of August, 1854. The invention was of a very simple nature, and would be easily understood; and, as the scientific and practical men about to be called would explain, was one of considerable importance and value. In laying gas or water-pipes, one great desideratum was that of a secure joint, and various forms were adopted for the purpose before the date of the plaintiffs patent. One of these was called the flange-joint, the nature of which would be explained to the jury; and another, the spigot and faucet joint. Each of these, though possessing advantages to some extent, had its inconveniences; and attempts were, from time to time, made to improve upon them. Amongst those improvements was one which was patented in America by Messrs. West and Thompson, and was also published in this country. This invention was known to the plaintiffs at the time they took out their patent, and was referred to by them in their specification. According to that plan, there was formed around each of the pipes to be joined, a rim, which was bevilled on one side, but not on the other. The packing was placed between the two faces of the pipes, which were drawn together by means of a band or collar. The packing in this case was not external, but between the faces of the pipes; and, having no internal support, there was nothing to prevent it, when pressure was applied, from falling inwards, or otherwise out of its correct position. Such was, as far as the plaintiffs knew, the state of knowledge at the time they took out their patent; and their invention consisted of casting, or otherwise forming at the ends of each length of pipe or tube a narrow rim, the outer edges of which were bevilled, so that, when one length of pipe or tube was placed in connexion with another, the two bevilled edges thus brought together at the juncture of the pipes formed a ring or groove. Over the juncture already named was fitted a socket, which was formed in two parts; and, in the interior of this socket there was a groove, to receive the rims of the pipes. The groove formed by the bevilled edges and the space in the groove of the socket, were then filled with lead, cement, hemp, or other material, for the purpose of producing an air-tight joint. The two parts of the socket were then screwed together by screw-bolts passing through flanges on each part of the socket. In the American invention, the packing was placed upon the face of the pipe; in this case, it was placed in the groove or valley between the two ridges referred to: so that, not only was there this advantage, that the packing received an internal support, but this further advantage, that it could be seen as soon as the collar was removed; while, by the amount of compression which could be brought to bear upon it in all directions, the most secure and effectual air or water-tight joint was obtained. It would be seen, therefore, that this was a totally distinct invention from everything that had gone before, and possessed advantages which none of them offered. The plaintiffs, in their specification, stated that they were aware that here-

tofore it had been proposed, when connecting together lengths of flanged pipes, to substitute for the screws and nuts ordinarily employed to draw and retain together such flanged pipes, to form each flange with one inclined surface, or to apply to each of such flanges a separate ring, formed with an inclined surface; and to effect the drawing together of those flanges by means of bands or collars, formed with corresponding inclined surfaces, the inclined surfaces of the collars being made to act upon the inclined surfaces of the flanges, or of the rings acting on the flanges. The plaintiffs did not claim as part of their invention the ridge with one bevilled surface, because that was already in use for the purpose of drawing together the two ends of the pipes, when the collar with a corresponding inclined surface was placed over them; but what they claimed was, the invention of a second bevilled surface, which came down towards the mouths of the pipes, so as, when brought together, to form a channel, or ring, or groove, around the connected parts, to receive and give internal support to the packing applied, which packing was compressed and retained in position by the connecting-collars or sockets. This was the invention of the plaintiffs, which they charged the defendants with infringing. He should mention that this invention had not been used to any very large extent, because the plaintiffs were not in a position to push it; but, still, it had been brought practically into use, and evidence would be given that at Halifax several miles of gas-pipe had been laid down with these joints, and the engineer of the corporation of that borough would tell them that they had answered most thoroughly. They had also been employed by the Great Central, the Chartered, and other gas companies in London. With respect to the infringement, he (Mr. M. Smith) might state that, some time after the plaintiffs obtained their letters patent, they were introduced to Mr. Hawksley, the eminent engineer, who highly approved of the invention, and stated that, as far as he knew, it was entirely new. He also recommended the plaintiffs to Mr. Milne, an officer of the New River Company. The pipes were put to a severe trial at the works of the defendants, and bore their trial remarkably well; and, when afterwards the company were required under their Act of Parliament to close a portion of the New River, they used pipes for the conveyance of the water which were jointed according to this invention. Subsequently, however, the company chose to have their pipes from a gentleman named Truss, who it appeared had taken out letters patent for the construction of pipes, and the mode of joining them, which the plaintiffs contended were identically the same as theirs. The mode adopted by Truss was to form at each end of the pipes a V-shaped flange, which differed from the plaintiffs only in the fact that the latter were rounded at the apex. The effect, however, was the same—there were the inclined surfaces upon which the packing was placed, which packing was afterwards pressed down by a collar or socket—in fact, the witnesses would state that, though there might be some little variation in detail, essentially the two constructions were the same. Upon the plaintiffs learning that this infringement had taken place, they made application to the company, which resulted in the present action. The only defence put upon the record at first was, that they had not infringed, and that the plaintiffs invention was not useful. However, some time afterwards, they asked leave to amend, by pleading that the invention was not new; and, under the present state of the law, they were obliged to give notice of any invention which they contended was an anticipation of the plaintiffs. Accordingly, they gave notice of two; one being the American invention of West and Thompson, and the other the patented invention of a person named Rowe. He (Mr. M. Smith) had already explained sufficient to show that the first was by no means an anticipation of the plaintiffs; and he was prepared to prove that there was nothing in Rowe's which in the slightest degree detracted from the novelty which the plaintiffs claimed. He thought it was rather ungracious in the defendants, who had used the plaintiffs invention for some time, to turn round at this late period and say that the invention was not new; and he was convinced that, before the case had proceeded far, the jury would be satisfied that the plea of non-utility was as idle and unsustained as that of want of novelty.

The several specifications having been formally put in, the following evidence was called:—

James Nasmyth, Esq., examined by Mr. HINDMARCH.

I am an engineer, and have had a great deal of practical experience in the construction of machinery of all descriptions, during the last thirty-five years. I am well acquainted with the construction of cast-iron pipes and their joints, and of the mode of securing them. According to the old method of securing a joint, there were inconveniences depending upon the use to which the pipes were applied. The drawing produced shows two well-known modes of securing joints which were practised before the date of this patent. One describes a method of flanges and screw-bolts. The flanges were at right angles with the sides of the pipes, and the screw-bolts passed through both flanges, and so compressed them together. According to that method, the packing was placed between the ends of the pipes forming a ring all round, and was secured by the compressing action of the screw-bolts drawing the ends of the pipes together in the direction of the axes. According to the other method, the end of one pipe was introduced within the enlarged end of another pipe, a ring of packing being introduced all round, and driven in very nearly to the end of the smaller pipe within the enlargement of the other. When the ring of packing was introduced, it was secured sometimes by pouring in molten lead, and, at other times, with cement. Pipes used for conveying water are sometimes subjected to a great amount of internal pressure, occasionally to many tons weight upon the square inch, but varying, of course, with the use to which they are applied. It frequently happens that 200 or 300 feet of elevation produces such pressure. A great variety of material has been used for packing. In the case of flange-pipes, the most commonly used was rope yarn, sometimes dry, and sometimes lubricated with red or white lead and paint, for the purpose of filling up the minute interstices. With the other description of pipe, tarred hemp, or spun yarn, is first driven in, and then melted lead poured on. This is commonly called the spigot and faucet joint, the chief disadvantage of which is the difficulty of removing any individual pipe out of the series. The standard length of pipe generally used for gas and water is 9 feet, so that in any great length of pipe there would be many joints; and if, from any imperfection in the pipe or for other reasons, a length was required to be removed, great difficulty was encountered on account of the pipes interlocking one another; and, just in proportion to the perfection with which the joint was made, was the difficulty of removing the pipe. So much so was this the case that, if a pipe had to be taken out, the usual mode was to cut it through with a chisel, instead of attempting to disjoint it. That operation was accompanied by a certain degree of damage to the remaining joints that were in contact with it; hence, the value of a contrivance which enabled any individual pipe to be taken out, without disturbing its neighbours. The only disadvantage of the flange-joint, was that it was not quite so secure as the spigot and faucet; also, I would observe that, in order to make the flange-joint perfect, they had to draw the pipes in endways, so that there was a tendency to pull the joints already made, asunder; while tightening up the particular joint that was being made. The packing also was not so secure, there being less surface. The flange-joint is a very good joint if properly made, but there is a great difficulty experienced when introducing a new pipe into a series, to get the packing into its place effectually. I should scarcely say it was less secure, if I may be allowed to correct my evidence; for, if both are well made, they are equally secure. The difficulty is that when you are going to introduce a new length of pipe within a joint already made, you require a space for the packing at each end; and, as you require that space, unless the distances are well ascertained, there is a difficulty in adjusting it. It is like putting a volume into the shelves in a library where the books are already tight; you have first to force the books asunder, and then there is a tendency to produce undue slackness in the other parts. I have read the plaintiff's specification, and have examined the construction of the joint which it describes. The drawing correctly illustrates it. In constructing his joint, he makes annular and angular ridges at the end of each pipe; and, when two ends of pipes are put together, these ridges form angular recesses, converging towards the joint to be secured. The packing is pressed round the pipe-ends within that recess, and the packing and the ends of the pipe are secured by a collar placed around on the joint and in sections. The interior of the collar is made so as to let the ends of the pipes come together, and one of its functions is to prevent those ends being driven asunder. The other function is to compress the packing firmly down towards the outside of the pipe, or against the joint—towards the bottom of the angular recess would be the better way of putting it—and against the joint all round the pipe. In my judgment, that makes a very secure and efficient joint. So far as I know, that improvement was new at the date of the plaintiff's patent—it was quite new to me. It is sufficiently described in the specification to enable a competent workman to understand the invention. I am acquainted with the construction of the American joint which this model represents. I have read that part of the plaintiff's specification in which they state they were aware that "heretofore it had been proposed, when connecting lengths of flanged pipes, to substitute for the screws and nuts ordinarily employed to draw and retain together such flanged pipes, to form each flange with one inclined surface, or to apply to each of such flanges a separate ring, formed with an inclined surface, and to effect the drawing together of those flanges by means of bands or collars, formed with corresponding inclined surfaces, the inclined surfaces of the collars being made to act upon the inclined surfaces of the flanges, or on the rings acting on the flanges." I think that describes the American joint, the distinctive feature of which is the mode of drawing the pipes together, which is effected by having a flange on the ends of each of the pipes, and bevelled backs, and an enveloping ring or collar, which, acting upon the bevelled backs, forces them together—if I might so express it, a sort of circumferential wedge.

Lord Chief Justice COCKBURN: Is there no packing between the two?

Witness: Yes; the packing goes inside.

Lord Chief Justice COCKBURN: Similar in some respects to the plaintiff's, except that the packing is here inside, and in the plaintiff's outside.

Mr. HINDMARCH: There is no annular recess to receive the pipe.

Witness: The packing is in between the ends of the pipes in the American invention, but in the plaintiffs it is altogether outside.

Lord Chief Justice COCKBURN: You can take the packing off without opening the pipe? Merely by taking off the collar you are at the packing at once?

Witness: Yes. Here the packing is obliged to be recessed, and you cannot get out any individual pipe, because it is "dowelled," or locked with another by the intermediate packing. That was a materially practical defect in the American system. If the joint was not thoroughly made, or the packing well arranged, it might get displaced; the workman who made the joint would not be aware of it at the time, and it would only be discovered to be an imperfect joint when the water was seen to come up through the street. In my judgment, the want of an internal support to the packing is an objection to the American joint, as it produces what I have called the dowelling effect, and permits the packing to slip out of its place into the interior. In that invention, the flanges are brought close together, to produce the requisite amount of pressure upon the interposed elastic substance, in order to make a water-tight joint. There is no angular recess round them to receive the packing, as in the plaintiffs.

Mr. HINDMARCH: In your judgment, is that joint a different thing to the plaintiffs?

Witness: Decidedly different. It varies in some very efficient features. The most important of them is that of the locking together of the pipes in the American system, so that you cannot remove any one pipe without disturbing the rest of the series. Then, again, you cannot inspect the goodness of the joint, or see whether it is efficiently and well made, until you have actually introduced water or gas, as the case may be, or find out that it is a defective joint, perhaps, at a serious cost and much inconvenience. On the other hand, the plaintiffs joint can be inspected during the progress of its manufacture; in fact, it is quite tangible. The joint-making material, and the lapping round this groove, can be touched in every way, to ascertain that it is effectually prepared before it is shut out of sight by the enveloping socket, and, if a pipe is defective, you have only to undo two bolts, and it is exposed to view, and can then be repaired. On the 22nd of this month, I visited the New River Company's premises, under an order of inspection, and I there saw some joints of pipes. This drawing is a correct representation of the pipe joints I saw upon those premises. The pipes were of 4-feet diameter, and the arrangement for forming the joint, and all the essential mechanical features of the plaintiffs invention, namely—two ridges at the extremity of the pipes to be joined there, so that when put end to end they formed a valley between them for the purpose of receiving the packing. The other portion of the apparatus I saw was an enveloping socket for the purpose of performing the same function as the plaintiffs—for pressing the packing down on the joint. The ridges in the defendants were rounded, and the plaintiffs are the V ridges; the only difference between the two is the use of curved ridges in the one and angular ridges in the other.

Lord Chief Justice COCKBURN: Substantially, the two things are the same?

Witness: Quite the same.

Cross-examined by Mr. BOVILL: I have been a maker of steam-engines for the last thirty years, and there are a great many pipes and joints about them. I have not laid down gas-pipes for public use, but I have for my own manufactory. I am acquainted with the ordinary mode adopted by gas and water companies for laying down pipes. I consider the main and distinctive feature of the plaintiff's invention to be, that he applies the packing to the exterior of the pipe, instead of between the ends, which gives an advantage of facility in examining and removing the pipe, and repairing the joint. The clip-joint is a very old invention. I dare say you

will find it in George Gregory, the great storehouse of those things; it has been known for at least a hundred years. It consisted of placing two plain ends of pipes together, without flange or projection, and without any packing between the ends of the pipes. On the outside of the pipes, and over the junction, was placed a packing of elastic material, and over the elastic material a collar formed of two pieces. The two parts of the collar were pressed tightly down upon the packing by screws. In that case, the formation of the joint could be examined as it was being made; and you could examine the pipe without inconvenience. I am acquainted with Rowe's patent, which was long before the plaintiffs. That was for joining pipes of glass and earthenware, which infers a brittle material; that runs through the whole specification.

Mr. Bovill: Does he describe a mode of joining pipes by means of packing on the outside?

Witness: No; he forms his joint by bringing the ends of his pipes together in contact with an interposed elastic material. That is an essential feature of the invention in most of the examples he gives.

Mr. Bovill: Just look at his specification. "Figs. 6, 7, and 8, represent two ends of pipes united or combined by means of two clips only. In this case, the grooves are made wider, and a short pipe of india-rubber, or other flexible material, is drawn over them, the clips being afterwards applied and bolted, as shown. There is also a collar of soft or elastic material previously placed between the ends of the pipes, to form a bed for them to press against." Does not that description and drawing show that he had an elastic material on the outside of the pipe and over the joint?

Witness: Yes.

Mr. Bovill: With indentations upon the pipe?

Witness: Yes, rectangular indentations—a very important distinction.

Cross-examination continued: The packing passed along the outside surface of the pipe, and joined into and through the indentations. Rowe's also had a further packing between the ends of the pipes, quite independent of the other.

Mr. Bovill: "Fig. 15," in the drawing attached to Rowe's specification, is "a longitudinal section, showing the junction of two ends of pipes, which may be employed as an external covering or case for that just described. The outer surfaces of the pipes are grooved in a peculiar manner with respect to the clips, in which is placed a short pipe of india-rubber." Does that describe an external covering or packing of elastic material on the outside of the pipe passing into and through grooves with the clip pressing upon the packing in those grooves?

Witness: Yes.

Mr. Bovill: Is the difference between that and the plaintiffs that he has a packing pressed down upon the very junction of the two pipes?

Witness: Yes; a very essential difference.

Mr. Bovill: And that in the plaintiffs the two ends of the pipes are drawn close together, and the pressure applied upon the junction?

Witness: Yes.

Mr. Bovill: And that the plaintiffs arrangement holds the two ends of the pipe in immediate contact?

Witness: Not necessarily; they do not need to be held in contact at all.

Mr. Bovill: They say: "Our invention consists of casting, or otherwise forming, at the ends of each length of pipe or tube a narrow rim, the outer edges of which are bevelled, so that, when one length of pipe or tube is placed in connexion with another, the two bevelled edges thus brought together at the juncture of the pipes form a ring or groove for the purpose hereafter mentioned." Then, again, I find, after describing the rims, they say: "So that, when the ends of two pipes similarly formed are brought in contact with an annular space, ring, or groove, will be produced suitable to receive and support packing."

Witness: It is not essential to the joint.

Mr. Bovill: Then he has a rim whereby he holds the pipes together.

Witness: Yes.

Lord Chief Justice Cockburn: Then you withdraw the statement that it is not essential the two ends should be in contact?

Witness: It is not essential to the making of the joint in the plaintiffs invention that they should be brought in contact—not mechanically essential.

Mr. Bovill: But that is what he describes?

Witness: Yes.

Mr. Bovill: What you understand by the specification is, the bringing the two ends of the pipe in contact so as to form a groove?

Witness: I can make a perfectly water or air-tight joint by the plaintiffs specification.

Mr. Bovill: But point out any part of his specification in which he does not speak of bringing the pipes in contact.

Witness: I do not consider the contact as an essential feature in the invention. The object of the inclined surfaces of the ridges is to keep the pipes together; but, whether they are the fiftieth of an inch apart, or a quarter of an inch, I do not consider is an essential part of the invention.

Mr. Bovill: Then the object is to bring them together as close as possible?

Witness: Assuming it is so, it is to keep them there firmly.

Cross-examination continued: I am acquainted with Truss's patent. I do not know that the object of that invention is to make a flexible joint, and that the ends of the pipes are not brought close together.

Mr. M. Smith: I must object to this.

Mr. Bovill: I am going to show that there is no infringement.

Lord Chief Justice Cockburn: If it shall appear that the whole object of Truss's invention is to produce something altogether different from yours, that may be one view of the case, and an important matter for the jury.

Mr. M. Smith: It is not to be proved by the specification.

Lord Chief Justice Cockburn: No; the specification is only to be used as a convenient mode of putting the question.

Cross-examination continued: One of the properties of Truss's invention is the making of an expensive and elastic joint. It will accommodate itself to any surface, and to the curves. The packing might be the material now in use—either the india-rubber band or the woollen band. The woollen packing is the sort of material commonly used. The clip used by him is divided into several segments. No doubt, from the nature of the formation and the arrangements made to admit of divergence, something depends upon the width of the groove. In the plaintiffs invention, with circular clips, there would not be an opening or distance between the ends of the pipes of an inch; but the ends of the two pipes might be that distance apart, and still there would be a perfect joint. The opening might be 2 inches apart, if proper arrangements were made—if, for instance, the clip is made wide enough to correspond. In the plaintiffs plan, if I were to put the ends of the pipes 2 inches apart, the result would be entirely contrary to what he has described; at least, there is a distinction between the two plans in that respect. The mode of making the actual joint is very nearly the same in both cases. I have already said that one essential part of the plaintiffs plan was to keep the two ends together, having the pressure on the joint. That would be entirely defeated, I think, if you were to put the joints of the pipes 2 inches apart. In Truss's, used by the defendants, you might put the ends of the pipes 4 inches apart. I do not see how he is to make his joint water-tight under the clip. I believe that, with the ends 4 inches apart, and with a collar of corresponding size, you might make a joint water-tight with india-rubber; but the water would exude under certain circumstances. It is a new system of packing to me. A woollen packing might produce a water-tight joint if it were saturated with tallow. The object of the American patent was, that the incline on the outside of the rim should bring the two ends together. The object of the plaintiff is to keep the pipes together, not to bring them together. In that respect, the object of the American patent, and that of the plaintiff is different. The precise object of the American patent was to produce a compression on the intervening pipe. I admit that if it were not for the inclined surface, the plaintiffs pipes would separate, and defeat the object he has in view. There is no arrangement in Truss's plan, used by the defendants, for bringing together, by means of inclined surfaces and otherwise, the ends of the pipes. You might have those ends 2 inches and 4 inches apart. It is, no doubt, the failing of an elastic joint that they cannot be close together. Up to the time of Truss's patent, in 1859, the object was to bring the joints together as close as possible; I was not aware of any flexible joint up to that time. I know the form of Truss's collar, and of the projection in the centre. If two ends of the pipes were brought within an eighth of an inch of each other, the tendency of screwing tightly upon the collar would be to drive those ends further apart. It would be something like driving in a wedge, and separating them until the rim came on a line with the exterior part of the collar. The effect of the plaintiffs plan is, that the tighter you screw the more the pipes come together. When the plaintiff proceeds to make his joint, he puts in a quantity of packing which projects above the apex of the V's; there is a very severe pressure thus produced; and then this ultimately comes down, and prevents the pipes from diverging any further.

Mr. Bovill: Now, point out any part of the specifications of the plaintiffs, which shows that the object of the inclined surface was for any other purpose than that of bringing the pipes together and maintaining them there?

Witness: Here is a passage—"Over the juncture, a socket formed in two parts is fitted. In the interior of this socket there is a groove to receive the rims of the pipes. The groove formed by the bevelled edges and the space in the groove of the socket are now filled with lead, cement, hemp, or other material, for the purpose of producing an air-tight joint." If the two ends of the pipes were not brought together, but had an inch between them, the packing, if made of lead, wool, or hemp, would go into the groove, and would render it water-tight. I am certainly not of opinion that the wider the pipes are apart, the more water-tight they are. The specification points out that the groove may be filled with lead, but that does not mean solid lead. If lead were laid between two pipes, some of it might be squeezed into those pipes. If cements were used, they also would be passed into the pipes, if a gap or opening were made sufficiently spacious. Truss's plan might apply to the ordinary pipes made with flanges. For the plaintiffs plan, you must have pipes made expressly for the purpose, with inclined surfaces.

Re-examined by Mr. M. Smith: The pipe I saw at the New River Company's works was not an ordinary one with a flange, but it was a specially-prepared pipe. It was 13 feet diameter, and weighed between 3 and 4 cwt. The collar now handed me is one of Truss's. It is exactly like what is described in his specifications. There is what may be called a valley between the two ridges at the end of the pipe. To make a pipe flexible, you would not have the ends in contact according to Truss's plan. They might be in contact, if they were not required to be flexible. I do not know that there is any advantage in Truss's plan, in not having the pipes in contact, except where the ground is undulating.

Lord Chief Justice Cockburn: Although it might be a characteristic feature in the one case, that there was this capability of adjustment, yet I presume that where straight piping is required the effect would be the same in both cases?

Mr. Bovill: No, my lord, the effect would not be the same, because, according to this witness, the effect of our collar is to drive the pipes apart.

Mr. M. Smith: I beg to say that my learned friend is putting a great many words into the mouth of the witness which he did not use.

Re-examination continued: I have been asked a good deal about the ridge and the bevel at the back. That is a thing common to the American plan. The inclined surface on the other side, which may be called the front of the ridge, is new so far as I am aware. When the defendants packing is compressed by the collar, it is forced into the ring or groove. In the plaintiffs collar there is a double action. While the packing is compressed, a tendency to separate is kept up, and that is counteracted by the pressure of the clip, which brings them together. If the collar were made wider, it would allow a great divergence to the pipe. The packing might be a close packing of the joint, although there was a separation between the pipes. I cannot say to what extent that might be. It would depend very much upon the nature of the packing materials employed. There is not an absolute contact essential to the plaintiffs invention. When the clip of the defendants plan is brought down, there is not a tendency to draw the two pipes together. The angles are equal on both sides, and the diverging and converging between will be very nearly balanced. I think, there would be a slight squeeze, only of the packing; that there would be very little diminution of its permanent thickness. Particular portions might require a harder squeeze to make the joint a good water-tight one. That harder squeeze would force the packing into the valley by reason of the projecting ridge in the collar. The object of the projecting ridge in the defendants collar was to make a more concentrated pressure, as nearly as possible opposite the junction of the two pipes. That pressure would force the packing material into the valley. In my judgment, the more perfectly that was done, the more would the joint be rendered secure. The collar must arrest the divergence somewhere. The curves inside the clip appear to me to be for the purpose of preventing the pipes from unduly diverging. I should say the maximum divergence allowed is 3-16ths of an inch, but, I think, an 8th would be nearer the general mark. There was no ridge at all in the old clip-joint, nor was there any valley whatever. There was simply a collar, which was kept down by the clip. That was an effectual mode of closing the joints. It would depend on circumstances whether the pressure on that would be equally distributed. There was no provision made in it for more pressure on the band. Rowe's patent has no ridge like the plaintiffs, nor has it any valley at the ends of the pipes. I have seen what are termed the undulating grooves, and which were handed me by Mr. Bovill. Those grooves were not at the point of junction. I

believe the office of those undulating grooves was to hold a collar of an elastic material, so that the glass or earthenware tubes might not be crushed by the hard clips. The object of these grooves had nothing directly to do with the packing or stopping of the joint, but they were the means of attaching the metal flange with safety to a glass pipe, so that the pipe might be joined in any way with the flange or otherwise. So far as I am aware, there is nothing in Truss's patent which speaks of the amount of divergence that may be allowed. The purpose for which Rowe obtained his patent was not for making joints but for joining. The compressing force is altogether at right angles to the pipes, and distributed equally over the whole. The packing, in figure 7, goes between the faces at the ends of the pipes, and then there is a soft material placed round the pipe to prevent breakage and destruction. The amount of divergence must depend upon the size of the pipe. That would require 2 inches in a small pipe, and not much more in a larger one. If the plaintiff used a good jointing material, he must make a good effective joint.

George W. Stevenson, Esq., examined by Mr. M'CROBY.

I am a civil engineer, and have acted in that capacity for some years at the borough of Halifax. I am acquainted with the plaintiffs invention. I first became acquainted with it about six years ago. It was quite new at that time. I have had considerable experience with pipes, and the joints of pipes. I have laid down a great many lines of pipes of one kind or another. I have tried the plaintiffs invention. I laid upwards of six miles of pipes according to that invention in the borough of Halifax in the autumn of 1856. Those pipes are all still there, and have been ever since I laid them down. I have not examined them lately, but had occasion to look at them before for some purpose, and found them thoroughly good and efficient. They have been laid in places where heavy traffic was liable to pass over. In many respects, I consider them a great improvement upon the old plan. They form vertically tight joints. I am speaking of them so far as gas is concerned now. I have tried whether the joints would bear any pressure with water. I have laid them where there were undulations, inequalities of surface. In laying them down at Halifax for the conveyance of gas, of course there were undulations in the streets. Some of them were laid in ground that had been lately disturbed by settlement. To some extent, they were flexible. I have seen the plan adopted by the defendants, and I think I see a very considerable similarity between the two. It struck me the first time I saw it in these respects—in the use of the raised surface upon the ends of the pipes, and in the clip or collar to connect the pipes together. I think these are the main features of similarity.

Cross-examined by Mr. BOVILL: I did not go to the New River Company's works to see what that company were using. I should say that the inclined raised surface of the plaintiffs, on the outside of the pipes, is not for the purpose of bringing the ends of the pipes together, and keeping them there. In the course of my practice, I do not bring the two ends of my pipes together as closely as possible, neither do I intentionally leave a space between them. It would be utterly impossible to have the ends of the pipes so perfectly true that they should be brought actually together; but we bring these ends as close together as possible consistently with the irregularities on them, which must necessarily exist. For all practical purposes, they are brought as closely together as we possibly can do so. When they are once put together, they are fixed. We do not desire that they should be flexible, but they are flexible, and they cannot help being so. The flexibility does not arise from the imperfection of the casting.

Lord Chief Justice COCKBURN: If the irregularity of the casting causes it to be impossible to bring the pipes closely together, and that impossibility causes the flexibility, surely the original cause is in the irregularity of the casting?

Witness: That is so.

Lord Chief Justice COCKBURN: If you could get your pipes accurately cast, would not that enable you to bring them together?

Witness: If it were possible to cast the pipes practically true, then it might be that they would be close.

Cross-examination continued: In laying down the plaintiff's pipes at Halifax, I did not lay one part of them down longer than others. I should not think practically that that would answer. I think the plaintiffs was an improvement on the old plans in this respect: in the facility for removing the pipes without cutting or breaking the length. It was also an improvement, because it was both cheaper and more rapidly put together. I consider, also, that it was safer than the old plans, inasmuch as it did not require that a fire-pan should be carried about the streets, in which to melt the lead in the joints. I know of no other improvement it introduced. The old clip allowed the pipe to be removed without cutting or breaking, and the old clip-joint was equally cheap, or cheaper. It was also put together with equal rapidity, and it did not require a fire-pan to be carried about.

Mr. BOVILL: Now, then, these are the only three things you mentioned, in respect to which you said the one was an improvement upon the other?

Mr. M. SMITH: No; he did not say an "improvement."

Mr BOVILL: I asked him in what respects the plaintiffs plan was an improvement on the old plans, and he told me in these three particulars. I now ask him if there are any other advantages which the one plan possesses over the others?

Witness: I may tell you of the disadvantages of the old clip-joint. The principal disadvantage of it, in my mind, would be this: that you would not get a water-tight joint. A second is that there is nothing to prevent the end of the pipe from being carried completely away by the pressure of water; and the carrying away of that would affect all the other pipes in a similar manner, one after the other; and all the pipes would be rendered useless. There was no holding power. The American invention had not a holding power. It had a clip. I have not said that the holding power was new. The water-tight joint in the plaintiffs plan is an improvement by reason of the packing and the groove. I consider the holding power a great improvement.

By Lord Chief Justice COCKBURN: The disadvantage of the American invention is that the packing cannot be readily put between the two pipes, and cannot be examined when it is there. There is the holding power, and there is a good joint; but I do not exactly see how the last joint is to be made.

By Mr. BOVILL: I consider the American and the plaintiffs invention are identical, as far as regards the holding power. By the old clip system, you could not get a water-proof joint. I have not tried it, and should be sorry to do so. I have not tried Truss's plan. I have no knowledge of the American plan except from the model.

Re-examined by Mr. M. SMITH: Before adopting the plaintiffs, I had used the spigot and faucet joint in my works. The plaintiffs has the advantage which I have described, and, in my opinion, is a good water and air-tight joint. The pipes adapt themselves very well to the inequalities in the streets, because there is a play in the socket.

Mr. *W. Smith*, examined by Mr. HINDMARCH.

I carried on the business of a gas engineer, in co-partnership with the other plaintiff, at the time of the patent. The invention was the result of experiments continued by us for some time, in order to arrive at the result we attained. So far as I know, it was perfectly new at the date of the patent I was advised by Mr. Hawksley to take the invention to Mr. Mylne, the engineer of the New River Company; and, having obtained an introduction, I did so. I afterwards went to the premises of the company, and, by arrangement, made some of my joints there. I believe the foreman of the works was there, and saw what I did.

Mr. BOVILL said, if the object of the examination was to show that the defendants had used the plaintiffs invention, and afterwards took Truss's, it might be made short.

Examination continued: I did it upon two occasions, and the result was reported to Mr. Mylne. I saw him afterwards on the subject. I left some pipes there, and they are there now. The company did not adopt my plan at all, and I have not been to their premises since the last experiment.

Cross-examined by Mr. BOVILL: I had not seen the American invention when we took out our patent. I have never said that I had. I did not take mine from the American, and I have never so stated. I think it was about a month before I specified, that I heard of that invention. A model similar to the one produced was then shown to me by a gentleman named Roper, a coppersmith, on Snow Hill. I did not take the idea of bringing the ends of the pipes together, and holding them there, from the American. It was one of the main features in our invention to do so by inclined surfaces. I remember seeing Mr. Truss about this matter at the latter end of 1859. I showed him a small model like the one produced. It was not my joint, nor did I tell him I had taken mine from it. Mr. Truss produced to me his joint, and endeavoured to point out that it was different to mine. I told him it was identically the same in principle. I believe that he has ever since that time openly and publicly continued to advertise his joint. I did not take take any step to prevent his selling any, nor did I know that he had done so, though I made many inquiries. I never went to his shop to see whether I could buy any, nor sent any one for the purpose. I never saw his joint at the works of the South Metropolitan Gas Company. The first intimation I had of its being in use was at the New River Company's works.

Re-examined by Mr. M. SMITH: I told Mr. Truss he could not have been aware of what was in existence, or he would not have laid out his money in patenting his joint.

Mr. *John Johnson*, examined by Mr. M. SMITH.

I am surveyor and chief inspector of the Chartered Gas Company, and have held that appointment for twelve years. I held the same situation in the Leicester Gas Company before that. My attention was called to the plaintiffs invention in 1856, and I then made myself acquainted with its details. At that time it was new, as far as my knowledge went. I laid down a few pipes for the Chartered Company with those joints, as an experiment; and, on three different occasions, I have opened down upon them, to ascertain if they were sound. I found them perfectly sound. In my judgment, it is a very good and useful joint. The joints we used before were the spigot and faucet almost exclusively. We have used a few other joints, but only for connexions. I saw Truss's pipes being laid in the bed of the New River, and I thought the joints were those of the plaintiffs, or some modification of the same principle. They are identical, in having two raised surfaces at the end of the pipe, with a collar to fit over, and an outer packing to make the joint secure. They also have an opening between the ends of the two pipes, to allow for contraction and expansion. The operation, as far as the closing of the joint is concerned, appears to me to be very similar.

Cross-examined by Mr. BOVILL: Various contrivances have been adopted to effect that object, differing a little from one another. For many years past, it has been usual to cast the lengths of pipe with small projections at the ends. The Chartered Company first laid some down, according to the plaintiffs invention, early in 1857. There were inclined surfaces, but not for the purpose of keeping the ends of the pipes together. There were also inclined surfaces to correspond upon the collar. The object of these inclined surfaces was to hold the pipe in its position, and prevent it from being pulled out again. We laid the pipes with small spaces between them. They will not come together; there is always a space of about one-eighth of an inch to make the joints expansive. I understand, from the specification, that the object of the plaintiffs is not to bring the pipes into contact, because, on referring to the drawings, I find that they are shown with spaces between them; and I read the specification in connexion with the drawings.

Mr. *William Richards*, examined by Mr. HINDMARCH.

I have been a gas engineer for twenty-three years. I am well acquainted with the various descriptions of pipe-joints. I have examined the plaintiffs invention, and have read the specification. So far as I know, that invention was new at the date of the patent. I agree in what has been said by previous witnesses, that it makes a secure joint. I have also seen the joint which is called the defendants. In my judgment there is a great similarity in it to the plaintiffs, on account of the flexible compressible material being pressed in between the ends of the two pipes, by means of the clip, so forming a raised surface. It was a new and important feature in the plaintiffs invention, to have the packing pressed down towards the joint in the way they have done it. My impression is that the intention was to prevent the pipes being drawn asunder—there is a little play allowed.

Cross-examined by Mr. BOVILL: I know the old clip-joint. The clip presses the packing on to the ends of the two pipes, depending entirely upon the material and the pressure employed. It could not be so good a joint, because the pressure would not be even, and you could not be sure that it was equally pressed all round the circumference. It is possible to do it, but not sufficiently well to make a good joint. It would depend entirely upon the size of the opening between the two pipes.

By Lord Chief Justice COCKBURN: There is nothing to prevent the packing spreading laterally. If the faces of the pipes met accurately, it would not go in far enough to make a water-tight joint.

Re-examined by Mr. M. SMITH: The clip-joint was only made use of for temporary purposes. The plaintiffs invention is fit for permanent work—perhaps better than any I have seen.

Robert C. May, Esq., examined by Mr. M. SMITH.

I am a civil engineer, of Great George Street, Westminster. My attention was directed to the plaintiffs joint some three or four years ago. I had not seen anything like it before. I recollect Mr. Truss calling at my father's office about two years ago. He brought with him his patent joint, which he wished to recommend to my father, and, not being able to see him, he showed it to me. I thought there was a great similarity in it to that of the plaintiffs. The things which first struck me were, the projections at the ends of the pipes, the mode of inserting the packing, and the mode of holding it in by means of clips. I told Mr. Truss by no means to throw away money upon it.

Cross-examined by Mr. BOVILL: I have no interest whatever in this patent. I have subsequently read Mr. Truss's specification. I have seen his advertisements in the JOURNAL OF GAS LIGHTING.

Thomas Livesey, Esq., examined by Mr. M'CRORY.

I am the manager of the South Metropolitan Gas-Works, and have been so for upwards of twenty years. That company have introduced in two cases the plaintiffs joints. So far as my experience goes, they have answered the purpose very well. I have seen the drawings which illustrate the mode adopted by the defendants; and I agree with the witnesses previously examined, as to the similarity between the two joints.

Cross-examined by Mr. BOVILL: I have not laid down any of Mr. Truss's pipes. I may have tried them on the works. I have seen his advertisements, and know that he has been advertising his joints for some years. I remember Mr. Truss calling upon me several times about his pipes. He may have sent me some to try, but I have never actually laid down any. I believe they make a very good and flexible joint. I have never applied to Mr. Truss to know what he would supply 100 tons of his joints at. I have made applications to Smith and Truss to know on what terms they would supply. It was not so much a question of cheapness as that I thought I would give Truss's pipes a trial as well as the others. I cannot say whether Smith was at our works when Truss's pipes were there.

Mr. *William Brooks*, examined by Mr. HINDMARCH.

I am an engineer and patent-agent, carrying on business in Chancery Lane. I have been in practice in that description of business for upwards of twenty-five years, and am well acquainted with all the various descriptions of pipes and pipe-joints in use during that period. I know the plaintiffs invention, have read the specification, and have heard the evidence of Mr. Nasmyth and the other witnesses. I agree with them in regard to the nature of the invention and its utility. With reference to that portion which respects the pressure of the packing into a groove around the joint by means of a clip or collar, that was a novelty at the date of the patent. In my judgment, it is a material portion of the invention. I have made myself acquainted with the construction of the defendants joints. I saw some of them being laid down between the New River Head and the Lower Road, Islington. I have no doubt they were similar to those which have been spoken of here to-day; but I have only now had the opportunity of personally inspecting them. In my opinion, the joint which the defendants use is substantially the same as that of the plaintiffs. It struck me so on the first occasion I saw them, on account of their having projecting surfaces to receive the packing between the two joined ends, pressed on by a clip or collar, which at the same time acts on the opposite surfaces of the projections in a manner substantially the same as those represented by the plaintiffs, so as to compress the packing between the bottom of the valley formed by the two projecting surfaces, the sides of the valley forming a support to such packing. I agree with the previous witnesses as to the difference between the plaintiffs invention and all those which preceded it.

Cross-examined by Mr. BOVILL: I was professionally engaged upon the specification of the plaintiffs, but not upon their application for the patent.

A JURYMAN: Do you think that one joint would be as flexible as the other?

Witness: I think it would. There is just one point I should like to draw attention to: I think there is a difference in the form of the inside of the pipe given in one of the drawings to what it is in the other.

The JURYMAN: But, suppose the groove to be equal in each, and the clip to be of the same size, would not the one invention be as flexible as the other?

Witness: No doubt it would. I see in different sizes of pipes there are different forms of clips, some of them more deeply recessed than others. Still, there would be the same drawing in tendency in all.

Lord Chief Justice COCKBURN: Then, do I understand you to say that the flexibility of the joint depends upon the size of the clip? Take the plaintiffs pipe—suppose you were going over a level surface, the joints would be brought close together?

Witness: Yes.

Lord Chief Justice COCKBURN: Suppose you came to a place where there was an uneven surface of ground, and you wanted to adapt your pipe to the inequality, is the plaintiffs apparatus calculated to give the additional flexibility required?

Witness: To a certain extent, and partly from circumstances beyond control. The parts must be sufficiently free to allow of that elasticity.

Lord Chief Justice COCKBURN: Could you effect the object of giving greater flexibility, to enable you to adapt the pipes to the inequality, by any variation in the size or form of the clip?

Witness: Only to a small extent.

Lord Chief Justice COCKBURN: To what extent? You have heard it stated that with Truss's joint the pipes might be as much as a couple of inches apart, if you wanted it.

Witness: With the same size of pipe, you might do the same thing with the plaintiffs.

Lord Chief Justice COCKBURN: That is, with the same diameter of pipe you think that, by varying the size of the clip, you might give greater flexibility to the joint?

Witness: Yes; I think so.

A JURYMAN: That is what I wanted to know. It appeared to me to be so.

By Mr. BOVILL: I would not recommend such an opening as 4 inches with either joint.

This was the plaintiffs case.

Mr. BOVILL addressed the jury for the defendants. He said the New River Company were desirous to have the best joint they could get, and it was a matter of indifference to them whether they obtained it from the plaintiffs or from Truss. They had been using the plaintiffs joints, which they purchased from a person named Beggs, although the plaintiffs themselves did not appear to be aware of the fact. No doubt, the plaintiffs joint was a good and useful one—better than many of those formerly in use. But just as the plaintiffs improved upon prior inventions, so did Truss improve upon theirs, and had produced a better joint than they had patented. Improvements were continually taking place in such matters; and it was a very common thing for patentees to claim every species of improvement as an infraction of their patent rights, and put a stop to the whole course of mechanical invention in that direction. Referring to the evidence which had been given in support of the plaintiffs case, the learned counsel submitted that all the advantages which were asserted by Mr. Nasmyth and Mr. Stevenson to be possessed by the plaintiffs joint existed in the old clip-joint, which had been known for a hundred years. The invention of West and Thompson, which had been called the American joint, was known before the date of the plaintiffs patent. In that invention, there was a raised rim on the surface of the pipes, and on the outside or back of the rim was another inclined surface. By means of a clip, which fitted upon these inclined surfaces, which clip had an incline upon the inside of it, corresponding with the one upon the pipe, the two ends were necessarily brought together, a packing of flexible material being interposed. Besides this, there was another mode known before the plaintiffs—viz., Rowe's; and the drawings attached to that specification showed a packing between the pipes, and on the outside in indentations at right angles, the two ends of the pipes being held together by means of a clip or collar, which fitted into the indentations enclosing the elastic material.

Lord Chief Justice COCKBURN said, the difficulty he felt in the case was the one suggested by Mr. Nasmyth in his examination: that what Rowe appeared to have in view, was not so much to keep the packing in for the purpose of making a joint, as to prevent the clip, which was to make the joint, from breaking the brittle material, of which the pipes to which his invention referred were made. He doubted whether it would be the subject matter of a patent, to use the same apparatus for a different object. He would take the opinion of the jury, whether the two apparatus were identical; if so, though the purpose of Rowe was not identically the same as the plaintiffs—he would reserve that question.

Mr. BOVILL said, it also arose in two ways—it was substantially what the plaintiffs had done.

Lord Chief Justice COCKBURN said, that was another thing, but it could hardly be supposed that Truss thought so, or he would not have taken out his patent.

Mr. BOVILL proceeded with his address. He said Rowe's patent consisted of a mode of joining lengths of pipes formed of glass, earthenware, or other similar material, so as to effect air and water-tight junctions; which joints or junctions were so made as to afford facility for alteration or removal when required. The method employed by him was to draw together the ends of the pipes by means of metal clips bolted together, such clips being suitably shaped, so as to fit into grooves formed round the external surface at the two ends of the pipes to be united; a piece of soft or elastic material being placed so as to prevent injury to the pipes from the pressure of the metal clips, when firmly bolted together to form a tight joint. He also had another plan, in which projections or flanges instead of grooves were formed, the elastic material being used for the same purpose as before stated. The defendants joint also acted by pressure upon a groove and a raised surface. The learned counsel for the plaintiffs stated, that the pressure was upon the junction; but he (Mr. Bovill) would show that in one plan of Rowe's there was a pressure upon the junction, and in the other there was none. If the pressure upon the junction was said to be the distinctive feature of this case, he would show that in the sense of pressure between surfaces, there was no pressure upon the junction in what Truss had patented. The plaintiffs invention, as he had himself stated, consisted of bringing the ends of pipes together, by means of the inclined surfaces on the pipes, and the inclined surfaces on the clip which was placed around them. But this, it was admitted, was the same entirely as the American plan. The plaintiffs, however, did something more. Their object was to bring the ends of the pipes in contact, so as to have, in the solid bottom of the groove, a bed upon which to force down their packing. And yet, one of the witnesses had stated that the pipes might be 2 inches apart, the effect of which would be that the packing would go down bodily into the pipe, and thus defeat the whole object of the invention. Moreover, the plaintiffs, in their specification, spoke not merely of an india-rubber or a woollen packing, but of "lead, cement, hemp, or other material;" and it must be remembered that the junction had to bear the pressure of the water in the pipe, so that there must be a pressure on the outside to counteract it. In express terms, they stated their object to be to draw the ends of the pipes together, and holding them in contact. "Our invention," they said, "does not consist in forming pipes and tubes, so as to be connected together by means of inclined surfaces acting upon other inclined surfaces, when separately considered; but our invention relates to forming the ends of pipes or tubes (having inclined surfaces capable of being acted upon by a suitable collar or socket, to hold such pipes or tubes together), so that, when the ends of two such adjoining pipes or tubes are brought in contact, a channel, or ring, or groove, may be produced around the connected parts, to receive or give internal support to the packing applied, and whereby the packing so applied will be compressed, and retained in position by the connecting collars or sockets used." Now, the defendants—or, rather, Mr. Truss—did nothing of the kind. The efficiency of his joint depended, not upon the pressure at the ends of the pipe, but at the points of projection—the flexible material resting on the projecting parts, instead of being in the grooves, as in the plaintiffs.

Lord Chief Justice COCKBURN said, that, as he understood, was the difference between the parties. The plaintiff had a groove in between; he put his flexible material into the groove, and held it down fast with the collar. The defendants had no groove, but two projecting rims outside; and their flexible material was put over the projections, and fastened down with the collar. The result was the same as to making a joint. When upon even ground, and it was desired to keep the pipes together, the defendants just reversed what the plaintiffs did—the one made a hollow inwardly, and the other outwardly.

Mr. BOVILL said, it was not quite so. Mr. Truss did not want any hollow at all. He took the common ordinary pipe, and put his pressure upon the rim. In reality, it was a different matter to the plaintiffs altogether, and was as much an improvement upon theirs as theirs was upon the American invention, or the latter was upon the old joints. In the plaintiffs the pressure was between the two rims, whereas in the defendants it was upon them, and there was nothing required at the bottom of the space between to support the packing. The result was that he obtained a flexible joint, which was a great improvement upon anything that had been done before. It was all very well for the plaintiffs witnesses to state that in practice their invention was so, but in the specification it was not so. Their object was to make a joint which would not give way, and, having taken out a patent for one thing, they could not claim to interfere with some one else who had taken out a patent for another. He submitted, therefore, that in the present case there was no infringement. The moment the thing was understood, he believed it would be more a question for his lordship than for the jury. Truss's patent had no inclined surfaces; he did not keep the ends of the pipes together; he did not form a groove in the centre, nor was his pressure in the centre; and there was this remarkable fact that, whereas in the plaintiffs the tighter the collar was screwed the closer would be the juncture between the two; in Truss's, the tighter it was screwed the further it would be sent apart, the only restraint being the width of the collar. There was no pretence for saying that Truss had infringed the plaintiffs patent. The two things were entirely dissimilar, and it would be to interfere with the whole course of invention and discovery, to say that a person who had obtained a patent should stop every one else who endeavoured to produce an improved apparatus having the same object in view.

THURSDAY, FEB. 27.

At the sitting of the court this morning, Justice WIGHTMAN attended, and stated that, in consequence of the illness of the Lord Chief Justice, the further hearing of the case must be postponed until the sittings in London after Easter term.

SATURDAY, MAY 17.

Lord Chief Justice COCKBURN read over his notes of the evidence given for the plaintiffs on the former occasion. The following evidence for the defendants was then given:—

James Muir, Esq., examined by Mr. BOVILL.

I am a civil engineer, and engineer to the New River Company. I have had considerable experience in reference to the joints of water-pipes during the last twenty years. [Witness described the various methods invented from time to time, as given by Mr. Nasmyth.] In the plaintiffs invention, there are bevelled edges at the ends of the pipes on the exterior, as in West and Thompson's. There is a clip corresponding with those bevelled edges, which, when screwed tight, brings the ends of the pipes together, and holds them there. The packing is not between the ends of the pipes, but they are made so that when they are brought together a groove is formed, and the packing is prevented from being squeezed into the pipes, and the joint is then absolutely rigid. The New River Company have used many descriptions of pipes at different times. There is nothing new in having a bead on the end of the interior pipe. It is very important to have a flexible joint, so that the pipes may accommodate themselves to the inequalities of the ground. If Smith and Phillips's joint were made as specified, it could not be flexible. In Truss's patent, the packing is at the exterior of the rims or beads, and there is no groove formed as in the plaintiffs. It acts without the ends of the pipes being brought together, and forms a water-tight joint, even if the pipes are 2 or 3 inches apart. You may even have them further apart if the collar is made proportionate. You may also take away the packing from over the juncture—we have done so. The water-tight character of the junction depends upon the pressure by the clip on the tops of the rims, and there only. For some purposes, it is superior to any other. In my judgment as a scientific man, it is a very different thing to the plaintiffs joint. It is not the object of Truss's joint to draw the ends of the pipes together, nor is it the effect. There is no action of inclined surfaces, nor any pressing of packing into a valley or groove, as in the plaintiffs. As specified, the plaintiffs joint requires that the pipes should be brought into absolute contact by the action of the collar, and that the groove must be so formed as to give support to the packing. There is no similarity in the two, except in their being both clip-joints. It would not have been possible to apply the plaintiffs joint to 4-feet mains, as we have done Truss's. Truss's joint requires no peculiarity in the construction of the pipe; the plaintiffs requires a special flange and two grooves, and a bevelled projection of a peculiar construction. I have known the plaintiffs joint applied to a 9-inch pipe, but I do not think it could be used with a 4-feet main. The chief reason, I think, would be, that the pressure having to be distributed upon a large surface, it could not be made sufficient to resist the internal pressure of the water in the pipes. I can safely speak to 3 inches apart in the distance between our mains in form and curve; that could not be done with the plaintiffs. With the ordinary barrel, the pipes could be deflected to a certain extent before Truss's invention, and yet kept water-tight, but not so much as 3 inches. We have often to lay our pipes in soft ground, and where there are inequalities of surface. Some of them are in the old bed of the river, and that was one reason for applying Truss's joint.

By the JURY: In all cases where we used the broad clip and deflected pipe, the packing was cut away in the middle as a mere matter of convenience. It is quite superfluous there.

By Mr. BOVILL: We have not the slightest interest in using one joint more than another. We wanted the best, and tried to get it.

Cross-examined by Mr. M. SMITH: I do not know whether the company are defending the action; their solicitor is engaged in it. In the American invention, the pipe is bevelled on the outside; in the plaintiffs, the rim is bevelled on the outside, as well as on the inside. When the ends are put together, they form a groove, and the packing is pressed in against the sides and bottom of it. The first effect of putting down the clip upon the packing would be to press the pipes asunder until the collar touched the outside edges of the rim, and then they would be pressed together until they came into contact. Whether they were completely brought together would depend upon the extent of deviation from the specified plan. If brought together, there would be no flexibility.

By Lord Chief Justice COCKBURN: If they did not come into contact, there might be flexibility, though badness of fit. This contact is required by the language of the specification.

By Mr. M. SMITH: In Truss's, the rim is rounded, and not bevelled. There is a groove formed by the inclined surfaces, and the packing may or may not enter that valley, and rest on the inclined edges. There is a projection in the middle of the collar which would have the effect of pressing it in. In cases where great deflection was required, we used such a collar as the one produced; but those cases were exceptional—probably in six joints out of 250 they were employed. Where the packing is cut, a portion of it will, from its being elastic, swell against the inclined sides, but there is no pressure upon them. There are inequalities in the casting of the pipes, but these clips can be readily adjusted to meet them. In this particular also they differ from the plaintiffs, where the collar is in two parts, only making it impossible practically to have a firm and tight joint on a 4-feet pipe. Truss's collar might be used with the ordinary spigot and faucet pipes.

Re-examined by Mr. BOVILL: The water-tight character of Truss's joint does not at all depend upon the packing which may be pressed into the groove; whereas, in the plaintiffs, it does. In the plaintiffs, you could not take away the packing over the juncture.

By Lord Chief Justice COCKBURN: The pipes which we have used are substantially the same as some of those in the drawings attached to Truss's specification.

Lord Chief Justice COCKBURN: I doubt, in one view of the case, if that be so; it is not for me to put a construction upon the one specification and the other; at the same time, I should be quite unwilling to withdraw the case from the jury. It may be said by and bye, if the case goes to a court of error, that the judge ought to have put a construction upon the specifications, and say whether the one is not an infringement of the other; and, therefore, I will give you my opinion when the jury are gone out. I have an opinion upon the matter, which I will state, and give the other party leave to move. I will not give it now, because it may be said it had a bias upon the jury.

Mr. *S. Croom*, examined by Mr. WEBSTER.

I am foreman of Truss's manufactory of joints for pipes. Those joints have been advertised, and made extensively, since the date of the patent. I superintended the laying down of the defendants mains, in 1861, between the Sadlers Wells Theatre and the Dark Arch at Islington. They were laid in the bed of the river. I made some of the joints myself. The collar was made in five segments, and the pipes were curved nearly all the way. The length of each main was 9 feet, and the diameter 4 feet in the bore. The pipes were set close at one side, and 3½ inches apart at the other, in order to adapt them to the curve in the river. I think there were about ten of the pipes set in that way. The packing used was chemically prepared flat felt, and, as it was not wide enough for the aperture between one end of the pipes, I split it, and left the part over the juncture without any packing over it. It made a good water-tight joint, as the pressure is upon the top of the bead; the packing, which otherwise would have been pressed into the valley being of no value to the tightness of the joint. When the joints are made as described in the specification, they are flexible, and can be bent, still remaining water-tight. I do not think that would be the case with any other pipe coupling on a 4-feet main, except Truss's. I know the nature of the plaintiffs joint as specified. The packing is pressed down by the two inclined surfaces, and forms a rigid joint, the pipes being brought into actual contact. There is no drawing together by inclined surfaces in Truss's, the pressure being only on the top of the bead, which would be cast on an ordinary pipe.

Cross-examined by Mr. M. SMITH: There is no holding of the packing between the ends of the pipes in Truss's joint. There is a hollow space between those ends, and the packing is not pressed down there to make the joint water-tight.

Lord Chief Justice COCKBURN: It is quite immaterial whether it is pressed down or not, if it is an accidental circumstance, and does not help to make the joint water-tight.

Mr. *Thomas Seaville Truss*, examined by Mr. BOVILL.

I am a civil engineer, and a manufacturer of pipes and joints, carrying on business in Gracechurch Street, and am the patentee of the process referred to. I did not supply the pipes to the New River Company. The company got them made under a license from me. Ever since the date of my patent in 1859, I have been publicly advertising and selling my pipes without interference from the plaintiffs. When they attempted to interfere with the New River Company, I undertook the defence of this action. I am acquainted with the nature of West and Thompson's patent, and, as far as relates to the drawing together by inclined surfaces and a clip, there is not the slightest difference between their invention and the plaintiffs. Long before the plaintiffs patent, pipes were cast with a rim or bead at the end. My joint is applicable to the spigot-end of ordinary pipes cast with a bead at the end, and will make a water-tight joint with them—the plaintiffs will not, as it requires a particular groove so as to give support to the packing under pressure. The pressure in their joint is on the plain barrel of the pipe; in mine, it is on the highest point of the beads. Plaintiffs is a rigid, and mine a flexible joint. When they lay their pipes in a curve, it is done by casting a curved pipe. There are two classes of ordinary joints under my patent—one allowing for the requisite expansion and contraction of the pipes, and the other for special curves; the latter are constructed with broader bands. You may lay the pipes 14 inches apart, and more than that if necessary, until the parallel line reaches to the radius described on the model, and still have a water-tight joint. The only thing necessary is to have a correspondingly broad clip. The largest separation in the New River Company's pipes was 3½ inches. I do not see how you could get such an opening as that under the plaintiffs process. When in my joint the ends of the pipes are not brought together, it is not at all necessary that the packing should be in the hollow between them. You certainly could not do that in the plaintiffs. The divided clip or band was my invention, the object being to give direct pressure upon the whole of the area acted upon by the collar. When it is only in two parts, as in the plaintiffs, only a little more than a sixth of the whole area would be subject to direct pressure.

Cross-examined by Mr. M. SMITH: There is nothing in my specification about cutting away the packing over the juncture of the pipes There was no necessity to put it in as it is a matter of detail only. There is no pressure in the joint upon the packing on the sides of the two grooves formed by the rims, except that which arises from the compression of the material which is elastic. Such compression in a 48-inch main would not resist the pressure of 2 lbs. of water. The projection in the centre of the clip is not for the purpose of pressing the packing over the juncture. It is necessary to have something in the shape of packing at the junction of the strap. I am aware that that is not mentioned in my specification.

By the JURY: When I took out my patent, it was my intention in large pipes to cut away the packing in the centre.

By Mr. M. SMITH: I only pack the junctions of the segments of the collar when the pipes are set far apart. I am not aware that Rowe used a clip in four segments.

By the JURY: The object of the projection in the centre of the collar is to insure a water-tight joint in whatever direction the pipes may be placed.

Mr. *George Bullen*, an officer from the British Museum, produced a book, which was received in 1852, entitled, "The American Miller and Millwright's Assistant," containing a description of West and Thompson's invention.

Mr. BOVILL said the book described a pipe with inclined surfaces on the exterior, and a clip corresponding therewith. As the clip was brought down over the pipes, the inclined surfaces were drawn together, and there was a packing down the interior.

Mr. M. SMITH said there was no ridge or valley formed in that invention.

Lord Chief Justice COCKBURN said, in one sense, there was not.

Robert Jones, Esq., examined by Mr. WEBSTER.

I am a civil engineer, and engineer to the Commercial Gas Company. I am acquainted with all the various descriptions of pipe-joints spoken of by previous witnesses. I know what has been called the plaintiffs joint as described in their specification. I also know the defendants or Truss's joint. My own opinion is, that they are two very different things. As an engineer, I should say that it was impossible to make a joint as described by the plaintiffs so as to suit this large class of pipes. That portion of the packing between the ridges or surfaces of the pipes in Truss's joint is not important, and would not be required to make a tight joint either for gas or water. There is nothing in Truss's patent about pressing the packing into a valley or groove as in the plaintiffs. That portion of the packing between his projections might be cut away entirely; it could not be done with the plaintiffs, as the resistance of the gas or water would be stronger upon that portion of the packing. I agree with the other witnesses that the water-tightness of the defendants joint is by the pressure upon the outer flange or ridge.

Cross-examined by Mr. M. SMITH: I have got some of Truss's joints in use for steam purposes. I have not used the plaintiffs. The resistance in the defendants joint is on the apex of the bed; incidentally, there is a

pressure upon the inclined sides, which is due to the elasticity of the packing. I think it would be necessary when the packing is cut away in the middle to have the hollow part of the clip packed. It would not be necessary where the packing is not cut away.

Re-examined by Mr. WEBSTER: The packing under the junction of the clip was common to all clip-joints. The clip-joint is quite a common mode of making joints. The pressure on the sides of the ridge in Truss's is not necessary to resist the pressure of the water inside the pipe.

Lord Chief Justice COCKBURN: Where the packing is put in the defendants joint, a sort of groove is formed by the two meeting in the centre, and, therefore, there is a slight projection. Would there be anything to prevent the packing from being placed horizontally in the defendants without that projection? In this instance, the part where the clip presses the packing on to the pipe is always in a groove. Is that a necessary part of his system, or might that be placed more horizontally than it is now? The effect you see of this figure is that, when you come to get the pressure on the clip between the two junctions of the pipes, a certain quantity of the packing is forced into the interval. Then there is a dispute between the parties, whether it is at all essential to make the whole thing water-tight. What I want to know is, whether that particular configuration is essential to the defendants plan, or, whether he might have it more horizontal?

Witness: It is necessary to have it in that form, because the pressure is on the top of the ridge, and the angles of pressure cutting each other make it a tight joint.

Mr. WEBSTER: Will your Lordship ask whether he sees any drawing together as in the plaintiffs?

Witness: Not the slightest.

Mr. *Stephen Holman*, examined by Mr. WEBSTER.

I am a civil engineer, and have had considerable experience in hydraulic works. I have paid some considerable attention to the subject of pipe-joints. I have heard the evidence given in this case. It is essential in the plaintiffs joint, that the packing should have a bearing on the bottom of the groove, because the pressure is applied wholly on the exterior of the packing, and it would otherwise be driven into and stop up the pipe. You could not retain the packing in its position except by the cast-iron collar pressing upon the inclined surfaces, and it is so specified. The plaintiffs patent does not differ from West and Thompson's, as far as the drawing of the pipes together is concerned. In the former, the packing is placed on the outside, and, in the latter, it is placed in a groove or recess in the pipe. I do not see any necessity for inclined surfaces in Truss's joint. I take it that the ridge in the centre of the collar is placed there for a very different purpose than that of pressing down the packing—it is in order that, whatever the deflection of the pipes, to suit any particular curve may be, the pressure shall be equal throughout. The water-tightness of the joint is entirely due to the pressure on the outer edge of the flange. These joints are suitable to pipes as ordinarily cast; the plaintiffs described a special end of pipe as required for their invention.

Cross-examined by Mr. M. SMITH: In ordinary pipes there is a partial bead at both ends; one is larger than than the other; you could, with two sizes of clip, use the defendants joint. There are no inclined surfaces shown in defendants drawings—it is a rounded edge. If put close together, those edges would form a recess round the pipe. There would be a space for packing, but there is no bearing for it at the bottom, and the packing would form no support for the joint. If I have read the plaintiffs specification rightly, it is quite necessary that the pipes should be brought together. Truss's clip embraces the exterior of the pipes, but has no tendency to draw them together.

Re-examined by Mr. BOVILL: The plaintiffs, in their provisional specification, say that when it is required to form a curve in several lengths of pipe, the faces or surfaces which meet are so constructed as to be capable of being adjusted to form the bend or curve required, instead of constructing the pipe with a bend. It is evidently intended by that that the bend should be formed while the surfaces are still in contact. They would not be able to secure the packing unless the edges of the pipes were brought together.

Mr. *Richard Chrimes*, examined by Mr. WEBSTER.

I am a water-meter manufacturer at Rotherham, and have had very extensive experience in hydraulic apparatus. I have made the plaintiffs joints. The largest I have made were 12 inches in diameter; I have made some of 4 inches. They answer very well for forming a tight joint. They are made with inclined surfaces, the object and effect of which are to draw the pipes together, and hold them so. In my opinion, that is an essential part of their invention. We found, as the pipes increased in diameter, the difficulty of making the joint water-tight very considerably increased, so that in pipes above 4 inches in diameter we thought it both wise and expedient to turn the ends of the pipes with lead. I do not say we could not absolutely do the work without it, but we thought it necessary to take this special care in making them, or we should not have gone to the expense. I should say it would be utterly impossible to make a joint on the plaintiffs principle in a 4-feet pipe with clips in two halves. In all the joints which we made on this principle, there were the angular pieces, which are essential to the pipes, as described in their specification. There is a decided difference between inclined surfaces and rounded edges; the one would be represented by a straight line, the other by a pair of compasses curved. The objects of the two are different. Truss's patent is applicable to ordinary pipes, with the rounded bend or flange; the plaintiffs requires a special pipe cast for the purpose. They cast or form at the ends of each length of pipe or tube a narrow rim, the outer edges of which are bevelled, so that, when one length of pipe or tube is placed in connexion with another, the two bevelled edges thus brought together at the juncture of the pipes form an angular groove. I agree in the evidence I have heard, as to the applicability of Truss's. There are two points in which, I think, it is materially different to the plaintiffs—first, in having the clip divided into three or more parts, according to the size of the pipe; and, secondly, in the area of separation on the top of the circular rim or projection, being less, requires less force or power to make the joint water-tight, and is more certain of being so. The projection in the clip has nothing to do with the water-tightness of the joint; as far as that is concerned, you might take it away entirely, but, being made circular, it allows for the deflection of the pipes. You might make the inner curves of the clip flat, but you would not get so perfect a deflection. If made flat, the clip would still give the same pressure upon the upper flange or bead. With a smooth clip, there would be no bulging of the packing, except what was due to the compression on the top of the flange.

Cross-examined by Mr. HINDMARCH: The reason why the area of compression in the defendants joint is smaller, is because the pressure is on the apex of the bend, and it is not held together in the centre. The pressure there is lost, or would be very little, as compared with the other part, there being no resistance. It was not necessary to mention this in the specification; it is owing to a law, which would prevent it being otherwise.

Lord Chief Justice COCKBURN: If a man describes a mechanical contrivance or machine, he takes it for granted you know the laws which regulate it.

Cross-examination continued: The internal rim or projection is not necessary for making the joint, but for making it elastic and expansive, as explained in the specification, so as to allow for the end of any pipe so connected to be moved from a given level in any direction, as also for the pipes to be deflected without breaking or otherwise damaging the joint. The pipes may be deflected to a considerable extent if the pressure was not very great. The effect of securing the joint in the ordinary way would not be to draw the ends of the pipes together. I did not supply the pipes for the company. I supply them with water-meters, parts of which are connected together with the plaintiffs joint, the object being to facilitate the taking of the parts to pieces for the purpose of repair.

Re-examined by Mr. WEBSTER: It is from the experience gained in making those joints that I am able to give so confident an opinion respecting them.

Mr. *Truss* was recalled, and, in reply to questions by Lord Chief Justice COCKBURN, said: The object of making the projection was to secure the tightness of the joint. The diameter of that rise is the exact diameter of the pipe itself when the three pieces are brought together, so that the pipes will just go through, and that is all. When the surfaces are brought together, the diameter of the pipe is the distance between the two. When the pipe is moved in any direction, it tightens the packing against this rise. If it were taken off, there would be no pressure exerted there. If it were taken off, the joint would become slack instantly. That was the object and purpose of it; the joint is not complete without it.

Mr. BOVILL summed up the evidence for the defence, contending that the two inventions were totally dissimilar, and that there had been no infringement by the defendants of the plaintiffs rights. But, if the jury should be of opinion that they were substantially alike, then he submitted that the plaintiff had no ground of action, his patent being anticipated by that of Rowe.

Lord Chief Justice COCKBURN said he would reserve that point for the defendants.

Mr. M. SMITH said he understood his learned friend to give up the point of novelty.

Lord Chief Justice COCKBURN said he did not think Mr. Bovill gave up the idea of novelty in reference to the American patent.

Mr. BOVILL said he did, for this reason: that, with regard to the drawing together, it was admitted they both did it; but the packing was placed in a different position.

Lord Chief Justice COCKBURN said the packing was the great thing respecting which the plaintiffs said their patent had been infringed by the defendants. The drawing together was not the point of which they complained. If Mr. Bovill did not intend to rely upon the American invention, it simply came to the question of Rowe's specification, which was a matter of law; and the only question for the jury was that of infringement. He must either submit to the jury the point of novelty, on the ground of the American patent, as a prior invention, anticipating the plaintiffs, or that Truss's was an infringement.

Mr. BOVILL said he should not put it as an anticipation.

Lord Chief Justice COCKBURN: You say it was a step by which the defendants advanced in one direction, and the plaintiffs in another?

Mr. M. SMITH said he contended that the plaintiffs was not within Rowe's, and that it was not a matter of law. He was quite willing to go to the jury on the point. Both in the material employed, which was earthenware or glass, and in the mode of effecting his object, Rowe's invention was an entirely different thing.

Mr. BOVILL quoted from Rowe's specification, and argued that the object in that, as in the plaintiffs, was the making of a water-tight joint, by drawing the ends of the pipes together by means of metal clips suitably shaped, to fit into grooves formed round the external surface of the pipes, with an elastic material interposed. That being the case, he submitted the plaintiffs patent was invalid.

Mr. M. SMITH replied upon the whole case. He said, he thought it was very bold, on Mr. Bovill's part, to address the jury upon Rowe's specification when he had not asked any of his witnesses a single question on the subject. In truth, it was a different mechanical invention altogether, and not one of the witnesses called for the defence had ventured to say that the plaintiffs were within Rowe's patent. With reference to West and Thompson's, he was afraid that, if the inventions were identical, the deposit of the book in the British Museum would be held to be a publication; but, he did not think it would be necessary to allude to it, because the plaintiff, Smith, had stated that he became aware of the American patent a month before he specified, and, therefore, referred to, and entirely disclaimed that which West and Thompson had done. The learned counsel, after commenting at considerable length upon the evidence, concluded by submitting that the plaintiffs had not been anticipated in their invention, that Truss's joint was substantially the same as theirs, and, therefore, that they were entitled to a verdict for the infringement.

Lord Chief Justice COCKBURN summed up. He said: Although this case, in the evidence and in the observations of the learned counsel, has occupied a considerable time, I must say it seems to me that the whole matter lies in a very narrow compass. There are two questions for your determination: one, whether the invention of the plaintiff, which is admitted to have been useful and meritorious, was new at the date of the patent? the second, whether, supposing the patent upheld upon the ground of novelty, there has been an infringement by the defendants (the real defendant being Mr. Truss, under whose licence they have had these pipes constructed)? Now, gentlemen, I had imagined, upon the first question, that the great contest on the part of the defendants was to be with reference to the American patent, as being substantially the same thing as the plaintiff's. However, Mr. Bovill—no doubt, after proper consideration—has given that up, and only uses it upon the second question, which is that of infringement; but he rests upon Rowe's specification. Now, I will not trouble you by going into the language of Rowe's specification, but I will call your attention to the evidence of the only witness, I think, who was examined, in any material degree, upon the matter—namely, Mr. Nasmyth—because Mr. M. Smith is well founded in his observation that, in the evidence given to-day, Mr. Bovill has not called the attention of his witnesses to the question of Rowe's patent. Probably, he intended to rely upon it as a matter of law, and, upon the specification being put in, call upon me to construe that, and decide whether it was or was not in anticipation of the plaintiff's patent, so as to deprive that patent of the full merit of novelty. [His lordship read over the evidence given by Mr. Nasmyth.] That is the whole of the evidence upon the subject, and, upon that, you will be good enough to say whether you think that Rowe's patent, according to the specification, and as explained by the evidence, is such an anticipation of the plaintiff's inven-

tion as to deprive the latter of that novelty which is essential to the validity of the patent. If so, why then the defendant is entitled to your verdict, upon the plea that the plaintiff's invention is not new. But, we next come to a far more difficult and important question, which is, the question whether there has been an infringement in this case? Now, with regard to this, here again it strikes me that the whole matter lies in a narrow compass, and, although you have had a good deal of conflicting evidence, it is one of those matters in which a little ocular inspection and quiet consideration, attentively bestowed upon the subject, will help you to a conclusion much more safely than the consideration of the evidence of these scientific gentlemen, upon whom one could place absolute reliance, if it were not that, being called upon opposite sides of the question, they generally show more or less party bias, and party spirit. It is human nature, and we cannot help it; otherwise, we could not possibly explain how, upon such a matter as between persons scientifically conversant, there could be that dissimilarity of opinion which, in every patent case, we certainly do find. Now, it is admitted on all hands that there is nothing new in the various modes resorted to, to make a water-tight junction of pipes. You have to lay down pipes for gas or water extending over miles. You cannot cast, and lay down pipes of more than a certain length. You must make your pipe-joints tight enough to prevent the escape of water or gas, and various means have been resorted to for that purpose. There was the old clip-junction, which you have seen and heard described: that has its disadvantages; and, besides Rowe's, which I have already called attention to, there is this American patent. Now, what they did is very simple, but it is important as a step in the history of this branch of the invention. They wanted to make the pipes tight by laying the packing in between the pipes, and, in order to do that, the pipes have usually a flange or rim round the end; they make the surface of the flange or rim not on the same level as the surface of the end of the pipe; and then the two, being brought together, there is a groove or channel, or bed (call it what you please) between the two ends of the pipes, when thus constructed and brought together, into which some material of a water-tight nature might be introduced; and the whole was held together by a clip, or collar going round it. That was also found to have some disadvantages: the collar, as I understand, not fastening upon the material itself, the material was apt to fall into the pipes, and did not hold fast. Whatever the nature of its imperfection, imperfect it was, and then the plaintiff sought to make improvements upon it. That, he appears incontestably to have done. Instead of making a flange or rim at the end of the pipe, he makes the end of the pipe to consist of a little rim, which is depressed in comparison with the flange, which, in an ordinary pipe, would be at the end, or extremity of the pipe. The result is, that that being at the termination of each pipe, when the pipes are brought together, there is a little groove or valley between the two, and into that valley or groove is laid the elastic material; the object of which is to make the whole thing water-tight, and then the clip is put on. It is admitted that that was a meritorious invention; and, if the defendants have infringed that, they are liable in this action. I think there can be no doubt that in the trial of these cases it is very important (and juries should never forget it) that persons who by the exercise of their ingenuity, or by their superior intelligence, or by their experience and skill in the various departments of art and science, produce new inventions, should have that which the law gives them as a reward for inventing and discovering that which is useful to the community secured to them. So far as the plaintiff's invention is concerned, as here given to us, that ought undoubtedly to be secured to him against every one who seeks to invade his patent rights, and, if the defendants have done so, you will find so by your verdict. But, just as the plaintiff improved upon the American invention which preceded his, and would have been fairly entitled to say to them, had they patented their invention in this country and sought to visit him with an action for infringement of it—"My invention differs essentially from yours. True, it is, we have a common purpose—that of making the junction of pipes water or air-tight, but that is a common field of discovery and invention, and it is not the community of purpose which will entitle you, by inventing something else perfect, to stop up the way of all future improvements." As in justice he was entitled to use that language to those who have preceded him, so, in the present instance, if what the defendants have done is to endeavour to achieve the common object with an improvement on that which had gone before, and, if they have steered clear of the plaintiff's invention, and have produced something more or less similar or analogous, and, having the common object and yet essentially distinct and different from it, the plaintiff in like manner has no right to stop the way by saying —"I invented something useful and having reference to the same purpose, and therefore I say you have infringed my patent rights because you have done the same thing." It is between these two things that a jury ought to endeavour to steer clear, securing patent rights where a man has had the merit of inventing a discovery and making it available for public use and benefit; but, on the other hand, because a man has done something useful, so far as it may go, not allowing him to stand in the way of other inventors who may produce something having a community of purpose and object, but essentially different from what has gone before. The question goes to this: is the invention of the defendants the same, substantially, or, is it distinct, with reference to means and adaptations? He uses an elastic material for the purpose of making these pipes water-tight, he also puts a clip over the elastic material So did the American, whose invention it is conceded now on all hands the plaintiff does not infringe. But then comes this question: is the mode in which the pipes are joined, and the mode in which, by means of the clip, the elastic material is supposed to make those pipes water-tight, the same in the defendants as in the plaintiff's. The defendants say "No, and for this reason: you so construct your pipes as that, in their construction, they form a groove or valley; into that valley is placed an elastic material, and it is then fastened by a clip. I do not do that; my pipes are brought together, but my elastic material is not laid in a groove or valley: it lies outside the pipes, and is fastened simply by the clip on the external surface of the pipes. It is as much distinguishable from yours, as yours is distinguishable from the American's." The defendants sought, on the cross-examination of the plaintiffs witnesses, to show that there was an essential difference in one respect in the purpose which they both had, because, while they said they had this common purpose in view, the making the junction of pipes or tubes water-tight, theirs had the peculiar characteristic of making the pipes flexible, so that they would accommodate themselves to inequalities in the surface, or to the soil in the beds of rivers; whereas the plaintiff's are necessarily fixed, from the nature and character of his invention. The answer of the plaintiff's witnesses was, "That it is not so, because our pipes can, by a little necessary variation in the size and width of the clip, also be made to accommodate themselves to those inequalities." Now, I must say, if the evidence for the defendants is to be believed, the difference in the degree of flexibility which can be attained under the one system and the other is a very materially different thing; because, when we hear that they can have their pipes as far off as feet in comparison with inches, the difference is very marked. But that may be only collateral; and, if it is only an accidental advantage, and the two things are substantially the same, it would not deprive the plaintiff of the right to say that the defendants have infringed. No man has a right to take my patent and improve upon it without making me some compensation, or without first obtaining my consent; but, when you are considering whether the two things are substantially identical, it is certainly important to see whether there may not be some collateral purpose which gives a different character to the whole thing. The defendants seek to show that, by saying that their pipes can be laid down with a degree of flexibility which is not to be found in the practical operation and working of the plaintiff's system. Independently of that, the great point upon which the defendants insist is, that they do not lay their elastic material in any groove, or between the pipes, that they lay it down on the external surface, and fasten it down by means of the clip; and, although they say it is no part of their specification, or part of the merit of their invention as contained in their claims, still it is a remarkable feature in the system, and one entitled to consideration when you are to determine the question, whether the two things are identical. The plaintiff meets the defendants by saying: "You put your material into the groove which lies between the ends of the pipes, and you so press it down between the pipes; and its introduction between the pipes contributes materially to the water-tightness of the junction." Now, there the two parties are at issue; and, certainly, it does appear to me to be a very material circumstance to be attended to in determining the question. It is plain from the plaintiff's specification, and the evidence of the plaintiff's witnesses, that the great purpose of his system is to get the elastic material firmly pressed down into the groove or valley which surrounds the junction of the pipes so as to prevent the water getting out of the pipes upwards or downwards, or laterally. The defendants say: "We do not do that at all; we do not press it down into the groove or valley, but keep it upon the external surface of the pipe." But the plaintiff says: "To a certain extent, you clearly have some opening, some separation, however comparatively small, between your pipes; and the effect of the pressure is necessarily to press down a portion of the materials into the V-shaped interval between the pipes." Then, say the defendants—"If that does happen, it is accidental, it is only from the effect of the elasticity of the material, and the necessary pressure there must be to make the elastic material lie firmly upon the external surfaces of the pipe. It is not necessary to our system, although it is an advantage in our system. It is the pressure between the two sides which really makes our junction water-tight." Upon that you have heard the evidence, and it does not, if you believe the gentleman who comes here on the part of the water company, rest simply upon specification; happily, it is no matter of theory upon which you might have the most eminent scientific witnesses differing. If we believe his evidence, they have had occasion, in a variety of instances (no less than ten), owing to irregularities of the surface in laying their pipes, to separate them at their junction to a considerable distance; and in those instances, because the material was not wide enough to serve the purpose, they cut it in two, and put it on simply at the two ends, leaving the centre entirely uncovered, and it answered the purpose perfectly, and the pipes have been water-tight at their junction from that moment. This will tend, I think, very much to show that the entering of the material into the junction of the pipes, if it does enter by the force of the pressure, is not an essential part of the defendants system. The plaintiff says immediately, "nor need it be of mine. I do not want my pipes to meet; my pipes may be separated, too." It appears certainly by the witness that if you did adopt the clip to the purpose, you might have the pipes separate to the extent of an inch, or a couple of inches. The witnesses do not carry it further; but, on the other hand, I think, when you come to read the specification, it is impossible not to see that the intention of the plaintiff is to have his pipes in contact: "Our invention," they say, "relates to forming the ends of pipes or tubes (having inclined surfaces, capable of being acted upon by a suitable collar or socket to hold such pipes or tubes together) so that when the ends of two such adjoining pipes or tubes are brought in contact, a channel, or ring, or groove, may be produced around the connected parts to receive and give internal support to the packing applied, and whereby the packing so applied will be compressed and retained in position by the connecting collars or sockets used," showing plainly to my mind—I do not know whether they do to yours—that what he contemplated was bringing those ends together to form the groove, and that they never contemplated this action of flexibility of joints which has been suggested. But, on the other hand, it is not impossible that that never occurred to the defendants either: this idea of separating the pipes at the ends where you want to adapt them to variations in the surface, may have suggested itself since. The value of it is an important link in the reasoning on the subject, in endeavouring to arrive at the conclusion whether the two things are the same. It is for you to determine this as a question of fact, whether in your judgment the two things are the same. You have heard the conflict of evidence on both sides. The counsel for the plaintiff says he has suffered some hardships from his evidence having been given on a former occasion. If any hardship has fallen upon the plaintiff I am sorry for it, as my illness was the cause of it; but, on the other hand, it is sometimes an advantage when the first impression, which sinks into the minds of those who have heard a case, is left to work its way without the antidote being applied immediately. But what I advise you to do is to take these things into your own hands, and judge very much for yourselves. If you think it is not a part of the defendants system at all, that the elastic material should be placed between the pipes in any groove, or channel, or interstice, as the plaintiff evidently contemplates, and it is essentially a distinct thing; it will be for you to say whether this is any infringement of the plaintiff's patent. One way in which it occurs to me to test it is this—what if, instead of the defendants clip being made as it is, with that projection in the centre, it had been flat? what if, instead of the junction where the pressure takes place, instead of its having that circular band, the whole thing had been horizontal and flat, would the two things have been the same, then? If they would not, then it is worth while to consider how it is that the projection comes to be there? Is it for the purpose of achieving the same thing that the plaintiff effects by forcing his elastic material into the channel or groove at the end of the pipes? The defendants say not, and they give a reason why they say so. They say, "We rely upon that, not for the purpose of forcing the elastic material upon the pipes—that being in our system useless—we have it for the purpose of producing certain mechanical results with respect to the pressure upon the area over which the pressure is to extend. It is for you to judge whether you are satisfied with that explanation. If you think it is for the purpose of forcing the elastic material down into the pipe, and filling up the interstices, and that thereby the common object of water-tightness is produced, then it would probably be going a long way

towards a decision in favour of the plaintiff. But, as I said before, if you think that the two things are distinct, and that each man may fairly be left to the enjoyment of his own invention, without coming to the conclusion that they are necessarily interfering the one with the other, your verdict will be for the defendant. We are not trying the validity of the defendant's patent. He may be wrong; he may have patented that which he cannot uphold, which other people may have done before him, or which may be of no value. The main question for you—I had almost said the only question—is, whether the defendant's invention, as exercised and used according to No. 6 in the drawings annexed to his specification, is the same thing as that which the plaintiff has invented. If it is, the plaintiff is entitled to your verdict; but, if you think there is a substantial difference between them, you ought to find for the defendants.

The jury then retired to consider their verdict.

Mr. WEBSTER asked that, in the event of the verdict being against the defendants, he might have leave to move?

Lord Chief Justice COCKBURN said, if the court should be of opinion that he ought to have directed the jury upon the specifications, he would direct a verdict for the defendants, giving the learned counsel leave to move. But, if the verdict was the other way, there would be no occasion to do so, and he would then give the plaintiffs leave to move.

Mr. WEBSTER: On the formal question, that there was no evidence for the jury?

Lord Chief Justice COCKBURN: If it should be said hereafter that, where there are two specifications—one of each party—those specifications ought to speak for themselves, and that the scientific evidence should be put on one side—then, as I before said, my judgment is for the defendants.

Mr. HINDMARCH: Your lordship would give my friend leave to move upon the question of novelty, as far as Rowe's patent is concerned, and upon the question of infringement, if, on a comparison of the two specifications, your lordship ought to have directed the jury?

Mr. WEBSTER applied for leave to move also in reference to West and Thompson's patent?

Lord Chief Justice COCKBURN said, there was no question of law upon that. He had already reserved the point, whether the description of that invention in the book was a publication?

The jury returned into court, after an absence of about twenty minutes.

The OFFICER (the learned judge having left): Gentlemen, are you agreed upon your verdict?

The FOREMAN: We are.

The OFFICER: Please to answer these questions: Was the plaintiffs invention new at the date of the patent?

The FOREMAN: That we did not discuss.

A JURYMAN: Yes; with respect to Rowe's.

The OFFICER: Do you find that the plaintiffs invention was new at the date of the patent?

The FOREMAN: Yes.

The OFFICER: Are the pipes used by the defendants an infringement of the patent?

The FOREMAN: They are. Our verdict is for the plaintiffs.

WESTMINSTER, FRIDAY, MAY 30.

(*Sittings in Banco before Lord Chief Justice* COCKBURN, *and Justices* WIGHTMAN, CROMPTON, *and* BLACKBURN.)

Mr. BOVILL moved for a rule to show cause why the verdict in this case should not be set aside and entered for the defendants, pursuant to leave reserved, or for a new trial on the ground that the verdict was against evidence, and also for misdirection.

Rule *nisi* granted.

Miscellaneous News.

ORIENTAL GAS COMPANY.

The Annual Meeting was held at the London Tavern, on Monday, May 19—Captain BARBER in the chair.

The SECRETARY (Mr. A. Hersee) read the advertisement convening the meeting, and the seal of the company was affixed to the registry of shareholders.

The following report and statements of account were taken as read:—

In conformity with the deed of settlement, the directors have the pleasure to lay before the shareholders their annual statement of accounts, and to report that the affairs of the company are in a satisfactory condition, and progressing favourably.

The following table shows the rate of increase in the number of public and private lights during the year—viz.:

	Public Lights.	*Private Lights.*
1860—December	848	2365
1861—January	871	2529
February	889	2649
March	890	2907
April	892	3028
May	892	3079
June	893	3123
July	900	3176
August	910	3229
September	922	3259
October	922	3342
November	928	3361
December	945	3642

Your directors have to announce, with much gratification, that a contract has been entered into with the Government to light Fort William, and this important work will be executed without further delay; and they are happy to acquaint you that in the new districts, where mains have been laid during the past year, a large increase of business is anticipated from private consumers.

The rapidly-increasing business of the company, the prospect of extended operations, and the requirements of the gas-fittings department, have decided the directors to recommend to the proprietors a further increase of capital, by the issue of 50,000 shares of £1 each, on which it will be proposed to call up 5s. per share, to be made payable on the 1st of July next.

In conformity with the deed of settlement, an extraordinary general meeting has been called to consider and decide on this recommendation.

Your directors have the painful duty to record the death of their late esteemed colleagues, John George Hammack, and Charles Farquharson, Esqrs. In order to comply with the provisions of the deed of settlement, your directors have secured the valuable co-operation of Lewis Cubitt, Esq., a director of the Imperial Gas Company, who has accepted a seat in the direction of this company's affairs, subject to your confirmation, and they recommend that the remaining vacancy be not filled up.

The directors are happy to bear testimony to the zeal shown by William Anderson, Esq., in directing this company's operations in Calcutta.

The general revenue account shows a balance of £5693. 9s. 7d., out of which the directors recommend a dividend at the rate of 5½ per cent., free of income-tax, payable on the 12th day of June next, leaving a surplus of £537. 4s. 7d. to be carried forward to the next account.

The directors who retire by rotation are—John Allan and Walter Thomas Fawcett, Esqrs.; and the retiring auditors are—Henry McLauchlan Backler and James Sydney Stopford, Esqrs., who, being eligible for re-election, offer themselves accordingly.

Dr. — *Balance-Sheet, December* 31, 1861. — *Cr.*

To 98,710 shares, of £1 each		£98,710	0 0		
1,280 ditto, ditto (15s. paid)		960	0 0		
10 ditto, ditto (2s. paid)		1	0 0		
			£99,671	0 0	
Unclaimed dividends			34	11 11	
Wear and tear account—					
Balance, 1860	£ 279	3 7			
1861	404	15 0			
	£ 683	18 7			
Less—repairs paid for the year	501	15 10			
			182	2 9	
Amount due by the company			1,400	2 7	
Balance from general revenue account			5,693	9 7	
			£106,981	6 10	

By Amount of plant on the 31st of December, 1860		£78,376	16 4		
Expended during the year 1861		2,348	9 10		
				£80,725	6 2
Cost of plant to the 31st of December, 1860				£80,725	6 2
Amounts due to the company				3,692	7 0
Value of stocks, viz.:—					
Coals	£1,573	1 6			
Lime and purifying material	106	17 9			
Products	194	3 11			
Meters	821	0 0			
Fittings	7,893	15 0			
Pipes	2,262	17 3			
Sundry stores	1,653	11 2			
			14,505	6 7	
Balance of travelling expenses			460	0 2	
Ditto in Calcutta	£ 887	1 1			
Ditto in London	1,778	15 10			
Bills receivable	500	0 0			
India loan debentures, 1858	4,432	10 0			
			7,598	6 11	
			£106,981	6 10	

Dr. — *Profit and Loss, or Working Account, for* 1861. — *Cr.*

To Cost of coal used		£5,106	9 3		
Ditto of lime used		178	2 4		
Salaries in India and London		892	15 8		
Engineers salaries in India		760	4 5		
Directors and auditors		792	0 0		
Wages in India		1,260	15 7		
General expenses, including rent, gharry-hire, postages, advertising, printing and stationery, medical attendance, insurance, travelling expenses, and petty charges		974	19 10		
Wear and tear account		404	15 0		
Bad debts and allowances		12	8 5		
			£10,382	10 6	
Balance			5,418	9 1	
			£15,800	19 7	

By Gas rental		£12,790	14 5		
Coke, tar, fittings, and meters		2,984	17 8		
				15,775	12 1
Transfer fees				25	7 6
				£15,800	19 7

Dr. — *General Revenue Account, December* 31, 1861. — *Cr.*

To Dividend of 4½ per cent., to the 31st of December, 1860, declared at the general meeting, May, 1861		£3,937	10 0		
Income-tax		109	7 6		
			£4,046	17 6	
Balance			5,693	9 7	
			£9,740	7 1	

By Balance of general revenue account, 1860				£4,250	10 8
Ditto of profit and loss ditto, 1861		£5,418	9 1		
Interest		62	7 4		
				5,480	16 5
				£9,740	7 1

(Signed) JAMES BARBER, *Chairman.*

Examined with books and vouchers, and found correct—May 5, 1862.

(Signed) J. S. STOPFORD, H. Mc L. BACKLER, } *Auditors.*

The CHAIRMAN said, it became his duty to move—"That the report be received, adopted, and entered on the minutes." Previous to putting that resolution, he wished to make a few observations on the report, and then he should be glad to answer any questions that might be put to him by the shareholders. The most important paragraph was the announcement that they had at last entered the Fort. (Laughter.) It would be in the recollection of their earliest shareholders that, from the first meeting to the present time, there had always been some little discussion about the vexed question—the Fort. There could be no doubt that they had been very ill used and very hardly treated, but that had arisen a good deal from the force of circumstances, and it would be a difficult thing to point the finger of blame. There was no doubt that when Lord Dalhousie decided that a contract should be negotiated with the company for the lighting of Calcutta with gas, and the municipality were ordered to carry that into effect, he at the same time promised, by implication, that the company should have the lighting of the Fort, and, it was upon that promise, and that basis, that they negotiated for the contract for the lighting of Calcutta at all. On Lord Dalhousie's leaving India, there was a change of Government, and the commissioners found that they could not make a rate whereby the company were to be paid, without an Act of Parliament, or an act from the Legislative Council, just then established, and they did not choose to take the responsibility upon themselves of incurring a debt without seeing their way. The Legislative Council took their time before they armed the municipal commissioners with sufficient authority, and then came the mutiny. They had to go through the Court of Legislative Council to get an Act of Parliament before they could commence laying the mains—the usual Act granted to gas companies. After that, the authorities in the Fort were frequently changed; and each successor thought he could do something better for the Government by squeezing the company so as to get the gas a little cheaper. Great delay arose, and it was only through the zeal, and intelligence, and good management of Mr. Anderson, that they had been successful and obtained the contract. Mr. Anderson himself got tired of talking to this man and that man, and negotiating with this engineer and that commanding officer, but being on very good terms of acquaintance with all the authorities, and an intimacy with the commander-in-chief giving him a little weight, he wrote rather strongly, showing what the company had been led to expect from Lord Dalhousie, and that they were being ill treated in not having those expectations realized, and at last they had obtained, as stated in the report, a contract for lighting the Fort. It was not so good a contract as it would have been if it had come at first, but it was a good contract, nevertheless. It was one that increased their consumption at once over 20,000 cubic feet of gas at night, and there was promise of large increase. Speaking of the Fort itself, he said a great many gentlemen present had doubtless been over it, and knew more about it than he did, for it was more than half a century since he first saw it, and more than a quarter of a century since he last was there. For the information of those gentlemen who might not be acquainted with its nature, he would say that the Fort was in itself a town; it mounted 1000 guns, and required 10,000 men to garrison it. It contained a church, and was principally filled with public offices. Many of the staff located in Calcutta lived there, and there was always a large number of troops in garrison; so that, although the private lighting would go on increasing very much, they looked forward to the lighting of the Fort as a very valuable auxiliary to their revenue. It was his melancholy duty to announce that since they last met, they had lost two of their colleagues, Mr. John George Hammack, and Mr. Charles Farquharson. Mr. Hammack was a public character and a well known man, a magistrate for the county, chairman of the Ratcliff Gaslight Company, director of the Blackwall Railway, and an efficient man in every way. His acquaintance with Mr. Hammack began with the formation of that company, and he had derived great advantages from being associated with him as a business man at the board. For a very long time, Mr. Hammack had been in failing health, and, therefore, it could not be said that his death was unexpected. Of his tried and valued friend, Charles Farquharson, he found it difficult to speak. He was most unremitting in his attention to the interests of the company, always ready and willing to go anywhere in its service, and jealously alive to its interests. Under those circumstances, it became their duty to consider what steps should be taken to fill up the vacancies, and they were of opinion that if they could find a gentleman of integrity of conduct and business-like habits, who was intimately acquainted with the working of a gas company, it would add very much to their comfort and the interests of the shareholders. The subject was discussed amongst the directors, and they selected Mr. Lewis Cubitt, a gentleman who had been a shareholder from the very commencement of the formation of the company, and who had been a director for a considerable time of one of the most successful and largest gas companies in London—the Imperial. They, therefore, decided upon inviting Mr. Cubitt to join their board, and he having kindly accepted their invitation, the directors, under the authority of their deed, provisionally appointed him as a director, and they now called upon the shareholders unanimously to confirm that appointment. He thought the report, taken as a general report, would be considered very satisfactory. They had, hitherto, been travelling in the Parliamentary train, but were now shifting to the Express, and it would be found that would go ahead very fast. The figures given in the report as to the increase of private lights were only up to December last; and he would state that since the 31st of December, 1861, up to the 31st of March, 1862, the number of private lights had increased from 3642 to 4062. In fact, it was no longer a question of doubt. Prejudice had given way to self-interest; and it was the supply they now had to be anxious for, not the demand. The company were the only gas-fitters in Calcutta; and it was right for the interests of the shareholders, and of the consumers, that it should be so. Several other parties had attempted it, but failed, because their prices were very exorbitant, and their work was inefficiently done. In consequence of the bad work, and consequent escape of gas, some of the consumers had said they would have nothing more to do with it. The company had got over all that; and they were now fitting as fast as they could fit, not looking to profits on their fittings, but determined to look to their prospective profits by increased consumption. They felt the want of a large staff of fitters, for they had more work than they could possibly do; and so the directors at home were selecting good steady men to send there. Three were to set out that evening by the overland route. The late increase had taken place in private lights, for he did not think they could increase their public lights very materially; but, in private lighting, he was confident that they had not one tithe, or one-twentieth the amount to supply that they would have in the course of six or eight months. Some gentlemen had asked why the natives were not employed as fitters, remarking that they were very tractable and careful; and that, if they were superintended by Europeans, they could be taught to do their work well? He (the chairman) thought so, too, until he talked to their engineer, who was, unfortunately, obliged to return to England, on account of his health, who told him that he was in error, and that the natives were not to be trusted at all. He said that, when they were fitting gas-pipes, if there was a little crack, they would fill it up with putty, and then the leakage would necessarily follow. "Gas-fitting, in my opinion," he said, "can only be done by Europeans; and the sooner you send them out the better." The directors had sent out as many as they could. He had nothing further to say with reference to the report, but himself and his colleagues would be most happy to answer any questions that might be put to them. In the meantime, he would put the resolution—"That the meeting confirms the appointment of Mr. Lewis Cubitt to his seat in this direction."

The resolution was seconded, and unanimously carried.

The CHAIRMAN then moved—"That the report of the directors be received, adopted, and entered on the minutes."

Mr. BROWN seconded the motion.

Mr. THOMPSON inquired whether the contract with the authorities of the Fort was confined to street-lights, or whether it included the lighting of the barracks?

The CHAIRMAN said the public lights would include the soldiers barracks.

Dr. BEATTIE said there were no private residences in Fort William; they were all public quarters. There would be but few lights in the streets, but the barracks were very extensive. Many of the officers lived there.

Mr. ALLAN said that the staff officers would not be provided with gas at the expense of the authorities; they would have to pay privately for the lighting. The Government would, of course, provide gaslights for all the soldiers in the barracks; but the directors looked for an increase, independently of their contract, by the lighting of the staff officers barracks, which they would have to fit and light at their own expense.

Dr. BEATTIE said he rather differed from Mr. Allan with regard to the admission of fittings into the staff officers quarters. He was sure the Government would not permit any of the officers to introduce gas-fittings on their own account; but the Government would introduce them, and he was afraid would charge the poor officers for their use.

Mr. ALLAN said, he meant that the company would have the benefit of the further receipts from lighting the quarters of the staff officers.

Dr. BEATTIE said, he was sure the present gasometer would not suffice for the demand they would presently have upon their gas.

The CHAIRMAN said they would have a special meeting at the close of the one which was being held, to consider the question of increasing the capital.

Dr. BEATTIE said he observed in the report a sum of £404 for wear and tear account; he supposed it was a per centage in some form or other.

The CHAIRMAN said it was decided at one of the meetings that they should take 2s. per ton of coals carbonized for the wear and tear fund, which had been accordingly done.

Dr. BEATTIE said his own conviction was, that they would soon be receiving a dividend equal to what Mr. Cubitt gave them from the Imperial Gas Company—no less than 10 per cent. He should not be satisfied until the directors were able to say that the revenue did admit of a 10 per cent. dividend. The charges for management would necessarily go on a little increasing, but not *pro ratâ* with the consumption of gas. He also hoped the directors would think it necessary before long to call the shareholders together half-yearly, and perhaps give them the dividend half-yearly.

Mr. CHOWNE said there was one item in the account he should like to ask a question upon. On the credit side of the general statement, there was an item, as if it was an asset, "Balance of travelling expenses, £460." He had no doubt the item was quite right, but he could not understand it. They had their debtor and creditor sides of the account; they debited themselves with certain accounts, that came to so much money, and wanted something on the other side. How could they bring that which he considered as expended, gone, and no longer in existence, as an item to their credit?

Mr. FAWCETT said, during the past year, they had had to send over a larger number of men than they had ever had before, especially gas-fitters. The agreements with those men were made for five years, and the directors considered that, as the item for travelling would only be one large expense, it would not be right to debit the profit and loss account of the year in which that expense was incurred with the whole. They, therefore, had determined to put one-third of the travelling expenses to this year, and had carried the remainder to a suspense account, to be written off during the time of the men's engagements.

A SHAREHOLDER inquired whether, the number of directors being reduced, the same sum had been divided among them as formerly?

The CHAIRMAN said, it had not. The directors were entitled, by the sanction of the shareholders, to £850 a year; £790 was set aside this year for the remuneration of the directors, including the auditors.

The report was then unanimously adopted.

The CHAIRMAN said, the next resolution he had to move was—"That John Allan and Walter Thomas Fawcett, Esqrs. be re-elected directors of this company." He thought there could be no doubt about that, if the proprietors knew the efficient manner in which they had discharged their duties at the board, and their constant attendances and usefulness.

A SHAREHOLDER asked how many times they had attended at the board during the year, and the number of meetings that had been held?

Mr. BROWN said, he could answer that question, which he thought a very proper one. He had not been absent himself more than twice during the whole year, and believed Mr. Allan had not been absent once. They not only felt it their duty to attend the regular board meetings, but also to look in very frequently at other times. They felt that their business was not finished on merely board-days or committee-days; and, as to his friend, Mr. Cubitt, who was a very great acquisition to the company, he not only had attended every meeting, but, if he might be allowed to use an Irish term, he had attended more than every meeting, for he attended their meetings even a day or two before, so as to be perfectly conversant with the affairs of the company. He was very glad the question had been asked, because every director felt it to be an incumbent duty and a great pleasure to be constantly looking to the interests of the company. (Hear, hear.)

The resolution was unanimously carried.

Mr. DEW moved—"The re-election of the late auditors, Henry Mc Lauchlan Backler and James Sydney Stopford, Esqrs." They were two gentlemen who had been devoting their attention to the duties of auditors during the whole of the period of the existence of the company; and he had great pleasure, from his knowledge of their business habits, in proposing their re-election.

Mr. CHOWNE seconded the motion.

The CHAIRMAN said, the board, in the first formation of the company, considered it the best thing they could possibly do for the interests of those concerned to select, as accountant, a gentleman of strict character and integrity, and well acquainted with India, because their plant was in India; and their next care was that he should be associated with a gentleman who thoroughly understood gas accounts. There could be no doubt that Mr. Backler, who had been so many years secretary to the European Gas Company, was perfectly competent; and he could only say that, as directors and shareholders, they felt exceedingly obliged to their auditors for the very careful and zealous manner in which they had performed their duties.

The resolution was unanimously adopted.

Mr. FAWCETT said, he had now the pleasure of proposing a resolution which he hoped would be carried without any amendment: it was—"That a dividend, at the rate of 5½ per cent. on the capital of the company, be paid on the 12th of June next, free of income-tax." As he was proposing that resolution, he would take the opportunity of saying a word with regard to their contract with the Fort authorities. He thought it right that the meeting should know that the directors had entered into a contract for ten years, and they expected that it would bring them in £1500 a year, irrespective of the private lighting in the officer's barracks, &c. That was only the beginning, as they took it, of a much more important system of lighting within that Fort. To give some idea of what might be expected, he would state that 20 per cent. more lights were included in the contract, as completed, than were expected to be lighted when the negotiations first commenced. They considered it a most important addition to their works, and to their income. They had got the thin edge of the wedge in, but would not be receiving the whole benefit for some time to come.

Mr. CUBITT seconded the resolution.

A SHAREHOLDER asked the number of people residing in Fort William, including the garrison.

Mr. ALLAN said, about 2000 people, sometimes more.

The resolution was then put to the meeting and carried unanimously.

Mr. CHOWN said, that Dr. Beattie had hinted at the possible policy of their paying a dividend twice a year instead of once. It was a thing worth speaking of, and he did not see any difficulty in the way of its being done.

The CHAIRMAN said, they had had it very seriously under discussion, and they thought that, as the dividend had been only 5 per cent., it was too small at present to divide half-yearly; but, after the close of the present year, if they should have Dr. Beattie's anticipated 10 per cent., then there was no doubt it might be divided half-yearly. He could assure the shareholders the matter had been very fully discussed by the board.

Dr. BEATTIE said, he had no wish to interfere with that policy.

The CHAIRMAN declared the general meeting at an end, and resolved it into a special meeting, for the purpose of considering the subject of the additional capital to the directors asked at the hands of the shareholders. They hoped to find that the *modus operandi* had secured them the confidence of the shareholders, and that they would have no difficulty in calling upon them to make the further subscription. The question had been put to him: "Don't you think our shares in the market are much too high?" His reply to that was, that high as they were here, they were 30 per cent. higher at the scene of their operations. He had received a letter from their manager at Calcutta by the last mail, stating that they were at 80 per cent. premium. He thought they would now see the necessity of their increase of capital, and that they would accordingly respond to the request that the capital be increased to £150,000 by the issue of 50,000 shares of £1 each, on which it would be proposed to call up 5s. per share to be made payable on the 1st of July next.

A SHAREHOLDER asked, if they had started gas-works in either of the other presidencies?

The CHAIRMAN said, they had not, but other companies had started, who occupied Bombay. At one time, they had talked of occupying Bombay, and he could most sincerely say that he entertained no jealousy towards those gentlemen who had sought public confidence by such a flourish of trumpets from their engineer: he hoped they might be successful. If, from the information they had, and the estimates they had made, the directors had thought they could have saved the shareholders of the Oriental Gas Company from loss, with a possible chance of gain, they would have preoccupied the ground.

Mr. DEW said, as to the proposition made for the increase of capital, he felt most cordially disposed to second it, and expressed his willingness to take the proportion of shares that might be allotted to him. He was sure that, if the expectations they entertained as to the extension of their works were realized, it would be impossible for them to carry it out without fresh capital; and he was quite sure, from his knowledge of gas undertakings, that unless a gas company had the means of extending their works as necessity, guided by prudence, would point out, they could never fully develop the prosperity of any company.

Dr. BEATTIE said, while he was satisfied with the manner in which they had taken the increase, *pro ratâ*, which was decidedly the proper way, though some companies did not behave with equal liberality to their shareholders, he hoped they would be able to manage without much addition to that, because, if their capital went beyond £150,000, he was afraid his anticipations with regard to the 10 per cent. dividend would not be realized during his life-time.

The CHAIRMAN said he hoped they should be able to use a very much larger capital, for the shareholders might depend that it would not be wastefully used.

A SHAREHOLDER inquired the probable cost of fitting up the Fort.

The CHAIRMAN said they had not had an estimate yet; but they expected it would take six or eight men fully six months to do it.

The resolution was put to the meeting, and unanimously adopted.

The CHAIRMAN said he should be happy to take off their hands any shares they did not like to subscribe for. The business of the day was now closed; and he hoped that at the next meeting they would show as good or greater progress than they had at the present.

Mr. DEW said he was sure the shareholders must feel gratified at the report which had been read to them, and the proceedings that had taken place upon it; and also at the conduct of the chairman and directors in managing the affairs of their company so satisfactorily as to bring them into their present position. He, therefore, had much pleasure in proposing—"That the cordial thanks of the meeting be given to the chairman and board of directors for their conduct during the past year, and at the present meeting."

Dr. BEATTIE seconded the resolution, which was put to the meeting and unanimously adopted.

The CHAIRMAN said, speaking on behalf of himself and his colleagues, they were much obliged for the cordial reception of that vote of thanks which had been proposed. It was the receipt of such acknowledgments from those who had confided a trust to their charge, that would encourage them to go on with faithfulness and seek to further the interests of the company.

Mr. THOMPSON proposed a vote of thanks to Mr. William Anderson, their manager in Calcutta.

The CHAIRMAN said, he had already alluded to him so strongly as to his negotiation with the Fort authorities, and his great zeal, kindness, and activity, in every way, that he had not made further mention of him. He most cordially agreed that there was no man more entitled to the thanks of the shareholders of the company than William Anderson of Calcutta. His zeal, his conduct, his perseverance, his industry, and his achievements, were beyond all praise.

The motion was seconded, and carried with acclamation.

The proceedings then terminated.

MALTA AND MEDITERRANEAN GAS COMPANY (LIMITED).

The First Ordinary General Meeting of the Shareholders of this Company was held at the London Tavern, Bishopsgate Street, on Thursday, the 29th of May—EDWARD HAWKINS, junr., Esq., in the chair.

The SECRETARY (Mr. E. P. Rowsell) read the notice of meeting, and the following report and statements of account were then submitted:—

The directors have to report that, on the 1st day of October last, the then existing gas-works, machinery, and mains, at Valetta, were delivered over to the company. The additional works, which agreeably to the terms of sale were to be erected at the expense of the late proprietors have already been, or shortly will be, completed. The late proprietors have also accounted to the company for all profits realized for the three months immediately preceding the date of the delivery of the works.

In April last, Mr. Hodgson Jones, the company's engineer, proceeded to Malta, by the desire of the directors, to see that all the terms of sale had been complied with, and that the whole gas-works and plant were in good working order. He was also to regulate the staff, and gradually to make such arrangements as he might consider advisable. Much difficulty having arisen in obtaining a site for the new gas-works necessary for the supply of the three cities upon the side of the great harbour opposite Valetta, Mr. Jones received full powers to select and purchase a proper site. He has not yet returned, but he has reported that he has satisfactorily performed what was committed to him. He has purchased an excellent site for £1860, and he has accepted the tender of a local contractor for the erection of the contemplated works.

Previously to Mr. Jones's departure, a manager of experience and ability had been appointed and sent to Malta, and improvement is already apparent in the returns which have been received. The demand for gas is rapidly increasing, from which cause, and from better management of the manufacture and distribution, considerable additional profit may be anticipated.

The shares of such persons as have failed to pay the deposit and calls have been forfeited. The directors purpose recommending to the meeting a resolution with respect to these shares.

The auditors in their report have very properly noticed the absence of vouchers for payments made in Malta. To that place, a new and very comprehensive form of accounts has been recently forwarded for use, and some irregularity has been incident to the change. The directors trust that, by the use of this new form, the monthly returns from Malta will be so complete as to render unnecessary the adoption of the auditors' recommendation to gain time by correspondence and explanations by holding the annual general meeting at a later period of the year. Should the experience of the next few months show the contrary, the directors will take immediate measures for giving effect to the recommendation of the auditors.

The directors have set aside out of the profits £120, as a reserve-fund to meet contingencies; and they propose carrying the balance remaining after payment of the dividends to be declared at this meeting, and of the interest or dividend due to the late proprietors of the works of Malta, under the agreement between them and the company, to the credit of a fund for equalizing the dividends, to be called the "dividend fund." The directors recommend that a dividend at the rate 6 per cent. per annum, for the nine months ending the 1st of April last, be made and declared upon all the capital of the company, exclusive of the deferred shares issued to the late proprietors.

In pursuance of the articles of association, the whole of the directors retire from office, and, being eligible, offer themselves for re-election.

The auditors also retire from office, and, being eligible, offer themselves for re-election.

Dr. — *Balance-Sheet, March 31, 1862.* — *Cr.*

To Capital (called up)			£19,045	0	0	
Less arrears—						
Deposit	£1,237	10	0			
First call	2,472	10	0			
	3,710	0	0			
				£15,335	0	0
Vendors, balance of purchase-money				10,000	0	0
Sundry creditors				1,025	18	10
Profit and loss account				768	2	9
				£27,129	1	7

By Outlay (plant, &c.)				£24,042	19	9
Preliminary expenses				1,279	9	10
Suspense account				46	12	0
Stocks on hand—						
Coal	£409	1	6			
Coke	3	13	0			
Lime	4	16	5			
Gas	9	13	5			
				427	4	4
Sundry debtors				974	8	7
Cash in hand				358	7	1
				£27,129	1	7

Dr. — *Profit and Loss Account, for the Nine Months ended March 31, 1862.* — *Cr.*

	Expended in or on Account of London.	Expended in or on Account of Malta.		
To Coal		£1,317	8	0
Street lighting		99	14	11
Wear and tear		4	13	1
Rents	£20 0 0.	15	0	6
Salaries	132 0 0.	162	0	3
Wages		240	5	10
Directors remuneration	250 0 0.			
General expenses	53 9 4.	78	19	7
	£465 9 0.	£1,918	2	2
		465	9	4
			£2,383	11	6
Balance carried to general revenue account			768	2	9
			£3,151	14	3

By Profit during the three months ended Sept. 30, 1861, handed to the company by the vendors	£313	15	0
Gas, from Oct. 1, 1861, to March 31, 1862	2,583	9	0
Coke, ditto, ditto	206	18	8
Purifying materials sold, ditto, ditto	12	2	0
Rents	25	0	0
Meter rental	4	1	6
Interest account	6	8	1
	£3,151	14	3

The CHAIRMAN moved—"That the balance-sheet and accounts, as presented to this meeting, and the report of the directors, be approved and adopted." In doing so, he said it might be as well to explain to the shareholders, who were of course not so conversant with the position of affairs as the directors, what was the object contemplated by the company, and what steps had been taken to carry that object into effect. The general object was to furnish not only Malta, but Corfu, and other places on the shores of the Mediterranean, with a supply of gas. At present, they were confining their attention to Malta alone, and the directors thought that, until they had successfully accomplished that part of the undertaking, it was better not to extend their operations to other places. Their intention was now specially directed to the supply of the town of Valetta, and three other towns situated on the opposite side of the harbour. The late proprietors had works only at Valetta. They were not quite so conversant with the mode of carrying on those works as the directors of the present company; and, not being so prosperous as they desired, they had no wish to retain them, and, therefore, they were induced to sell them to the projectors of this company at a price which the directors believed might make them extremely remunerative to themselves and their co-proprietors. He might add that the works were delivered into their hands on the 1st of October last, and the directors necessarily for some time retained the staff under which they had been carried on previously. That staff, as he had just stated, had not carried on the works so as to make them very remunerative, and, consequently, the accounts for the past nine months were not altogether so satisfactory in their result as the directors hoped for the future they would be. They were much better than before, but nothing like what they trusted and believed they would be brought to. During a portion of the past nine months, the directors had been endeavouring to find a competent manager, and he (the chairman) saw some gentlemen present who would be able to tell the proprietors that it was extremely difficult to find just the man for such a post, and to take charge of works which had previously been in a disorganized condition. It would not do to take the first man that turned up; it must be one accustomed to gas-works, and able to manage them well. The directors believed that they had found such a man in the person whom they sent out in March last. Of course none, of the advantages resulting from his management appeared in the present accounts, but the directors had had returns for the month of April from him, which showed a much better state of things than was exhibited in previous returns, and they had no doubt that each month they would find a manifest improvement. Much had to be done; retorts had to be reset, and the arrangements for lighting the streets altered and amended. While sending out, as they believed, a thoroughly efficient manager, the directors had also thought it would be advantageous to the company if their consulting engineer was sent out to see that the works were delivered over by the late proprietors in a proper working condition, that the new manager was regulating everything in the best manner, and generally to arrange matters that might require supervision. The fact mentioned by the auditors respecting the accounts, was one of those matters which had not been satisfactory to the board, and they had sent out a new form for adoption, and it was expedient that the engineer should go out to see that that new form was thoroughly understood, so that the returns might be made as the directors could hereafter entirely rely upon. They had also been unable to obtain a site for the works which were to supply the towns on the opposite side of the harbour; and the consulting engineer had instructions from the board to select the best site he could find. They were happy to say he had done so, and at a price—£1860—with which they were perfectly satisfied. He might state that that site had been offered to them at a much higher price, and it was a site which, if Mr. Hodgson Jones had chosen one which of all others he would approve as the best adapted, he would have chosen this. It was just on the outskirts of the three cities they had to supply with gas, and on the borders of the harbour, so that coals could be easily landed at a small expense. While those works were being constructed, it would be necessary for the directors to make calls upon the shareholders to meet the expenses of those works, and for a certain time the money expended on them would be lying idle, because, of course, they could not be brought into operation until entirely complete. But they believed such improvements were taking place in the works at Valetta, that they alone would be able to pay a continuous dividend upon the whole of the money necessary to complete the works on the other side of the harbour, and the directors did not anticipate having to make any reduction of dividend. If such reduction, however, should take place, he had no doubt the shareholders would pardon the board for it, knowing that at least they were doing the best in their power to promote their interests. He thought the report had said all that it was necessary to say with regard to the accounts from Malta. It stated that those accounts were not exactly in a fit state to lay before the auditors, and had given a reason for it. The directors believed that they should be able at the end of each month for the future to lay the most satisfactory accounts before them, and that it would not be necessary, as they had suggested, to defer the meeting of proprietors beyond the month of May. The only remaining point he had to allude to was this: in preparing the articles of association, some discrepancies had slipped in between one clause and another, and between those clauses and the terms of the agreement with the late proprietors of the works; so that, supposing they were to abide by their articles alone, great injustice would be done to those gentlemen with regard to the payments to be made to them—in fact, the agreement made with them for the purchase of the works could not be carried out. It was only in preparing the report that the directors had seen how great those discrepancies were. They had, therefore, thought it better to revise those articles in the manner authorized by the Joint-Stock Companies Act. The form in which they proposed to take the resolution for the dividend would admit, after that dividend had been paid, of paying to the late proprietors interest on the money due to them, and carrying over a surplus to a reserve-fund; and they then anticipated effecting an alteration in the articles, and making the necessary payment to the late proprietors. The directors had mentioned in the report that they proposed to create two funds, one of which was a reserve-fund to meet contingencies and renewals of works. Every one conversant with gas-works knew that gasholders and other things perished in a way which could not be met by the ordinary wear and tear of each half year, and that it was absolutely necessary to make special provision by a reserve-fund for their renewal. Towards that object, the directors had laid aside 1 per cent. on the plant already in use, and they proposed continuing to do so. They also proposed each time to lay aside such a sum as might be necessary to form a fund to equalize dividends, so that in case in any one half year the profits should not be sufficient to pay the accustomed per centage, they would be able to do so by dipping into the dividend-fund.

Mr. NICOL seconded the motion.

The CHAIRMAN, in reply to Mr. Lambert, said the "deferred shares" were all for the benefit of the company. The agreement with the late proprietors was that the company should pay £24,000 for the works, which was a much less sum than they cost. The money was to be paid in this way—£10,000 as the calls were paid up, and the remaining £14,000 in deferred shares, which shares were to receive no dividend at all, until 6 per cent. had been paid to the proprietors. As soon as the 6 per cent. was thus paid, any surplus profits were to go to pay a dividend upon the deferred shares, and, after a dividend of 6 per cent. had been paid upon the whole capital of the company for two years, then the deferred shares became rateable afterwards *pari passu* with the ordinary shares.

Mr. MILLER inquired how much of the £10,000 had been paid to the late proprietors?

The CHAIRMAN said, no portion of it, because the articles of association contradicted, to some extent, the terms of the agreement. The directors thought that those terms were sufficiently advantageous to justify them in suggesting such alterations in the articles as would enable them to meet the late proprietors with liberality. They had now a considerable sum in hand; £1200 had gone in preliminary expenses, and the balance, together with the amount of future calls, would be applied to meet the payment to the late proprietors, and to the erection of the new works.

The motion was then put and carried.

The CHAIRMAN moved—"That a dividend at the rate of 6 per cent. for the nine months, ending the 1st of April last, be now declared upon all the capital of the company, exclusive of the deferred shares issued to the late proprietors."

Mr. NICOL seconded the motion, which was put and carried.

The CHAIRMAN moved a resolution cancelling the shares forfeited through non-payment of deposit and call, and authorizing the issue of new shares in their stead.

Mr. PRIDDEN asked, how many shares had been forfeited?

The CHAIRMAN said, 1200.

The motion was put and carried, and the retiring directors, Messrs. Hawkins, Duckworth, Edwards, Laing, and Nicol, and the auditors, Messrs. Backler and Daniel were re-elected.

Votes of thanks to the directors and auditors were also adopted.

The CHAIRMAN, in answer to a proprietor, said, Mr. Hodgson Jones had not yet returned from Malta, and it would be necessary to know more of his arrangements with the contractors before the directors could say how soon they would have to make a call. At present, they did not require more capital, but, probably, in the course of a year and a half, they would call up the whole, and due notice would be given when it became necessary.

METROPOLIS GAS SUPPLY.

CITY COURT OF SEWERS, GUILDHALL, TUESDAY, MAY 20.

The usual Weekly Meeting of the Commissioners was held this day—Mr. DE JERSEY in the chair.

Dr. ABRAHAM said, he desired to call the attention of the court to a matter of some importance—viz., the conduct of the gas companies supplying the City. Those companies were now engaged in pulling up the streets in all directions, and it was desirable that the engineer should be requested to watch their proceedings. He understood that in one of the districts in the City alone as many as between 800 and 1000 openings or pipe-trenches had been made, and he himself had seen eight or ten of these openings in Liverpool Street, Bishopsgate, only that morning. Upon inquiry into the object of these numerous openings, he found that the deed of confederacy between the gas companies had been signed, sealed, and delivered, and that they were dividing the City into three districts; each company, as he was informed, being about to supply one of such districts with gas. He strongly complained, on the part of the citizens, of the great annoyance caused by the taking up of the pavements, and he thought it was most important that the commission should be informed whether the companies were exceeding their authority in so doing, or whether they were only exercising the powers given them by the Act of Parliament?

The CHAIRMAN suggested that, as the question of the supply of gas was now before the General Purposes Committee, it would be better to refer this matter to them, so that they could report upon the whole subject at once.

Dr. ABRAHAM agreed in the suggestion, and the matter was accordingly referred.

Dr. LETHEBY (at the last meeting of the commissioners) stated, that the time had arrived for making his usual quarterly report upon the quality of the gas supplied by the Great Central Gas Company. He asked for instructions whether, under the altered state of circumstances, not having been appointed examiner under the provisions of the Metropolis Gas Act, he should continue to make his report, and whether he should confine that report to the gas of this company? At the request of the commission, he now reported on the illuminating power of the gas supplied to the City of London by three of the metropolitan companies—namely, the Commercial, the Great Central, and the Chartered. The following is the tabular statement of the results of the experiments:—

Company.	Where Tested.	Number of Examinations.	Illuminating Power in Sperm Candles of 120 Grains.		
			Max.	Min.	Aver.
Commercial	London Hospital	39	16·10	12·39	13·9
Great Central	" "	231	15·01	11·04	12·74
" "	Finsbury Square	87	15·64	10·40	12·44
Chartered	" "	87	16·26	10·54	12·85

The examinations were made in accordance with the directions of the Metropolis Gas Act of 1860, the gas being burned from an argand burner of 15 holes, with a 7-inch chimney, at the rate of 5 cubic feet per hour.

Dr. ABRAHAM inquired what number of times the illuminating power of the gas supplied by the companies had been under the standard required by the Act of Parliament?

Dr. LETHEBY said that perhaps in one-fourth of the experiments made by him the gas supplied had been under the Act of Parliament standard.

Dr. ABRAHAM said there was one thing which was of very great importance to the public, as it was fraught with considerable danger—he referred to the irregularity with which the gas in the City was supplied at a late period of the night. On a recent occasion, he was called up about two o'clock; and, when he left his consulting-room, the gas was burning. On his return home, after paying a professional visit, the light had gone out, and the room was filled with gas. Had there been a light in any other part of the house, the probability was that an explosion would have taken place, and it was impossible to tell what damage might not have arisen. He believed that the companies were in the habit of turning the gas off in the night to a very serious extent, and he thought it became a question for the court to consider what steps should be taken by them in so important a matter.

Mr. SAUNDERS said, he was glad to have some corroboration of the state-

ment which he made at the last court. He frequently had to remain in business until a very late hour, and he found that, about the time named by Dr. Abraham, the light from the gas was very much diminished. It sometimes went out altogether, and, upon being relighted, burned with a small feeble flame. He suggested that Dr. Letheby should be instructed to report, not only upon the maximum and minimum illuminating power of the gas, but also upon the pressure at which it was supplied at various periods during the night.

Dr. ABRAHAM said, he would submit a motion on the subject, as he felt that the commission were bound to do all in their power to protect the public. He thought that, as the companies had increased the price of the gas to 4s. 6d. per 1000 feet, it behoved the commission to see that they carried out the requirements of the Act of Parliament in every particular, especially that part relative to the illuminating power and quality of the gas supplied to the consumers. He moved—"That the question be referred to the General Purposes Committee, with instructions to consult the solicitor, as to whether it was expedient to take any legal measures in reference thereto? and that Dr. Letheby be requested to furnish the committee with the details of his examinations of the gas supplied by the several companies."

Mr. GREEN said, the observations which had been made bore out the statements of the Carburating Company, that they could not get a sufficient pressure, and that was the cause of the complaints made about defects in their process.

After some further conversation, the motion was put and agreed to.

TUESDAY, MAY 27.

At the Meeting of the Commissioners this day—Mr. DE JERSEY in the chair,

Dr. ABRAHAM said he should like to ask whether the solicitor's opinion had been taken with regard to the legality of the proceedings of the gas companies, in digging so many holes in the streets for the purpose of taking up a few old pipes?

The CHAIRMAN said that that question had been referred to the General Purposes Committee. They had held a meeting on the previous day, and the question came before them, but nothing had been done up to the present moment.

Dr. ABRAHAM stated that he had been obliged in three cases in his district to have the stones, which were put down by the gas company after they had opened the street, removed, and new ones put in their place. He advised the commissioners to look to their districts with regard to this particular point. He supposed every one was well aware that it was very difficult, after taking up flag-stones, to replace them without being chipped or broken. In two or three instances, he had seen the gas companies men put down cracked ones, and had called the inspector's attention to the fact, who succeeded in getting new ones put down. He (Dr. Abraham) thought it would be well to call the attention of the inspectors generally to that circumstance, because it was monstrous that the companies, in order to get up a few old pipes, should rip up the carriage and footways of the streets, and then lay down the pavements in a slovenly manner, and frequently with broken stones.

The CHAIRMAN said, he would just make one remark in reference to what the honourable member had stated on the last occasion. He then complained that the companies were parceling out the City, and that that was the reason why they were breaking up the streets. Now he (the chairman) had been informed only yesterday—whether rightly or wrongly—he could not say—that it was not exactly so. But the fact was, the Great Central Gas Company, when they came into the City, laid down pipes to certain houses without being engaged to supply them with gas. Those pipes had been laid down for many years, and the company finding that they occasioned a large amount of leakage and waste, determined to take them up, seeing there was no chance of obtaining customers. The subject, however, would come before the committee, and they would investigate it.

Deputy JONES expected that the chairman was quite right, as one of the gas company's men had been to his house, and in a very sly and artful way desired to see his meter. He told the man he could see what he liked, and, when he went to look at his meter, he found he was being supplied by the other gas company. The man then said, "All right; I have nothing to do with you." He then went to the next house; and, finding that that was not supplied with gas, he took the pipe away.

Mr. H. L. TAYLOR: That is the way they make out that they had got so many customers.

The CHAIRMAN said, Dr. Letheby wished to make a statement with regard to his report made on the last occasion respecting the quality of the gas supplied to the City. He believed there was some little misunderstanding about it.

Dr. LETHEBY said, he had been asked by the chairman whether the observations which he made at the last meeting of the commissioners, as to the deficiency in the quality of the gas, applied to all the gas companies supplying the City—if not, to which of them? His observations referred to three of those companies only—namely, the Commercial, which supplied the eastern portion of the City, the Great Central, which supplied the whole area, and to the Chartered Company. The observations which he made did not apply to the City of London Gas Company, because they had not, at the present moment, given him—or, at least, he had not had the opportunity of making—an examination of their gas.

Mr. H. L. TAYLOR asked, whether Dr. Letheby found the quality of the gas of the three companies satisfactory, when he tested it?

The CHAIRMAN: No; it was so stated in the report.

Dr. LETHEBY said, he made the statement that one-fourth of the examinations—and he had made some hundreds—showed that the gas was under the standard of the new Act of Parliament.

Mr. H. L. TAYLOR inquired what steps should be taken?

Dr. ABRAHAM: You should prosecute them.

Mr. BLAKE (assistant-clerk) stated that a copy of Dr. Letheby's report was sent to each company the day after the last meeting of the court.

Dr. ABRAHAM: Has any answer been received from them?

Mr. DAW: No.

Mr. H. L. TAYLOR said, he thought the matter should be taken up. He would prosecute them to the fullest extent

The CHAIRMAN said, the question was now before the committee. If the court thought it desirable, he would urge the matter on.

Mr. H. L. TAYLOR repeated that, unless the companies gave them what they bargained for, he would prosecute them to the utmost extent.

Mr. C. YOUNG thought Dr. Letheby's report should be referred to the solicitor, to see whether any action could be taken upon it. Dr. Letheb had made testings, and found that the companies had not complied with the Act of Parliament; indeed, they were very much below it. The court should at once see what could be done.

The CHAIRMAN said, as Mr. Young was on the General Purposes Committee when the question was before them, he might advise them to do so.

The conversation then dropped.

DR. J. NORTHOOTE VINEN'S REPORT ON THE GAS SUPPLIED BY THE SURREY CONSUMERS COMPANY:—

1862. Week ending.	Number of Observations.	Maximum Light. Candles.	Minimum Light. Candles.	Average Light. Candles.
May 24	4	14·84	13·40	14·09
„ 31	4	15·05	13·18	14·13

The volume of hydrocarbons averaged 4·50 per cent.; carbonic acid, 1 per cent. There was no trace of sulphuretted hydrogen, and but very slight indications of the presence of ammonia—on May 21, 23, 28, 30.

SOUTHAMPTON GAS COMPANY.—The Half-Yearly Meeting of the Proprietors of this Company was held at the gas-works, on Thursday last—Mr. Fowke in the chair; when a dividend of 4 per cent. was declared for the past half year, and the sum of £1500 was carried to the reserved fund. The price of gas to the public lamps since Michaelmas last has been reduced 5s. per lamp for the street-lamps, and to 4s. 9d. per 1000 to the private consumers.

SPALDING.—At a meeting of the Spalding Improvement Commissioners, held on Friday, the 23rd ult., it was unanimously resolved to purchase the gas-works in that town, on the terms upon which they were offered by Messrs. Maples and Crosskill, the present owners. The commissioners obtained power, by an Act passed in 1853, to make this purchase within ten years, upon such terms as might be mutually agreed upon; or, in case of difference, the price was to be settled by arbitration, but, the commissioners and the owners having agreed, the transfer takes place without any avoidable expence or unprofitable litigation.

SHEPPY GAS CONSUMERS COMPANY (LIMITED).—The annual ordinary general meeting of shareholders in this company was held at the Crown Inn, Mile Town, Sheerness, on Tuesday, May 20—Charles Allen, Esq., chairman of the board of directors, presiding. The report and accounts for the year 1861 having been read and adopted, a dividend was declared, by the recommendation of the directors, out of the profits of the company for the year 1861, at the rate of 7 per cent. per annum. It was stated that the works of the company had been in operation three years, and dividends had been declared, for 1859, at 3 per cent.; 1860, at 7 per cent.; and now, in 1861, again 7 per cent. The income from gas, coke, and tar, in 1859, was £793. 8s. 8d.; in 1860, £2369. 4s. 9d.; and in 1861, £3500. The manufacturing power and storing capacity of the works had been doubled since the starting of the company. A resolution was proposed by the chairman, and seconded by Mr. G. Lockyer, empowering the directors to purchase the works, plant, and other property of the Sheerness Gas and Coke Company. The secretary, Mr. A. W. Marks, read the correspondence which had passed in negotiating the terms for the purchase, with a synopsis of the draft agreement which had been drawn up. It was stated that this step was desirable on the ground that it would put an end to the competition, and enable the company to extend their business considerably, besides enabling them to obtain a remunerative price for their public contracts, which had not hitherto been the case. There was no intention of raising the price of gas to private consumers above the present rate of 5s. per 1000 feet; the consumers of the old company, who had hitherto been paying 4s. per 1000 feet, would be charged 5s., which was 2s. 6d. less than was charged by the old company before 1859. The price of gas was then 7s. 6d. per 1000 feet, until the new company, at starting, reduced the price to 5s., which was, as shown by their profits, a fair remunerative price. The new company was mainly composed of consumers themselves. This resolution was passed, with only two dissentients. Mr. J. Skinner proposed, and Mr. H. Miller seconded, a resolution for the increase of the capital of the company by the creation of 1000 preference shares of £5 each, to bear interest at the rate of 4 per cent. The proprietors of the old works had agreed to receive the value of their works, when assessed by two valuers, in these shares. On being put to the meeting, this proposition was declared to be carried. The vacancies in the board of directors, by rotation, were then filled up. Messrs. T. N. Allen and G. Lockyer, retiring directors, were re-elected, and Mr. J. Barnaby was elected in place of Mr. H. Temple, who declined re-election. A vote of thanks to the directors for their gratuitous services, and to the chairman of the evening, closed the proceedings.

GENERAL ASSOCIATION OF GAS MANAGERS OF SCOTLAND.—A meeting of gas managers was held in Edinburgh on Saturday, April 12, in terms of a circular issued from a meeting of a few of their number held in Kelso some time ago; the object of such meeting being (as stated in the circular) "to form an association for mutual consultation, and for the dissemination of such knowledge as may prove beneficial to those connected with the manufacture and sale of gas." The meeting was numerously attended, and gave promising evidence of the future success of the association. Mr. Clazy, of Kelso Gas-Works, was unanimously appointed chairman, and Mr. Adamson, of Galashiels Gas-Works, secretary and treasurer. The chairman, in opening the meeting, defined its objects, and made a few suitable remarks on the utility of such an association, and the benefit likely to accrue from a free interchange of opinion (on matters connected with gas) amongst its members—to them in particular, and to the public generally. He had always found—and was every day becoming more convinced of the fact—that, in endeavouring to promote the good of others, we were promoting our own; and he trusted that the members of the association would endeavour to act out the principle. He then called upon any of those present to make any remarks, or bring forward any resolution, bearing upon the objects of the proposed association. After some discussion as to the nature of the association, it was resolved that one be formed, and that it be called "The General Association of Gas Managers for Scotland;" and a committee was then appointed to draw up a form of rules and regulations to be submitted to another general meeting to be held in Edinburgh on the 10th of September. The business of the meeting being over, the members dined together, to the number of twenty-two, when a spirited discussion was kept up on various interesting subjects in keeping with the nature of the association. The meeting, after expressing itself highly satisfied with the proceedings, broke up at an earlier hour than it would have done but for the departure of the last train for their several localities.

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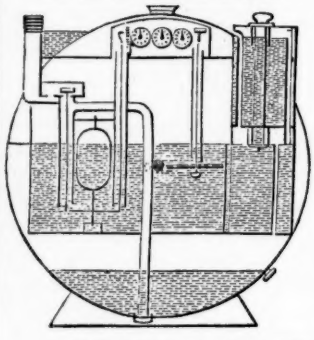

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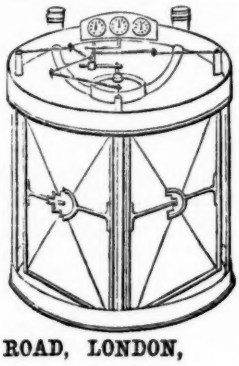

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May be seen on application to Mr. HENRY LYON, the Manager of the Station.

Tenders for the whole, or portions thereof, to be addressed to the Gas Committee, York Chambers, King Street, MANCHESTER.—By order,

JOSEPH HERON, Town-Clerk.

Gas Offices, York Chambers,
King Street, May 9, 1862.

PATENT Silica Bricks, adapted for Intense Heats of Copper, Iron, Glass, and Chemical Works.

PATENT SILICA RETORTS, as supplied to the Manchester Corporation Gas-Works.

Apply for Prices to H. J. WALDUCK and Co., Queen's Chambers, Market Street, MANCHESTER.

JOHN ROGERSON and CO. NEWCASTLE-ON-TYNE & MIDDLESBRO'-ON-TEES.

Wrought and Cast Iron Pipes, Cast-Iron Retorts, and all kinds of Foundry Work necessary for Gas-Works. Fire-Bricks and Clay Retorts. Gas Coals of every description. Pig, Bar, and Plate Iron.

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12, ROYAL EXCHANGE BUILDINGS.

WILLIAM RICHARDSON & CO., TUNNEL FOUNDRY, DUDLEY,

Manufacturers of Gasholders, and all descriptions of Gas Apparatus, beg to call the attention of Gas and Water Companies to their Double-Faced SLIDE-VALVES, which for Economy and Durability cannot be surpassed, and respectfully solicit a trial. Full particulars on application.

WILLIAM RICHARDSON (LATE OF DUDLEY),
CONSULTING ENGINEER,
PATENTEE OF THE VERTICAL OVEN RETORT
No. 367, PERSHORE ROAD,
BIRMINGHAM.

MR. PRESTON LUMB has removed to 42, PARLIAMENT STREET, WESTMINSTER, where he may be consulted on all matters relating to Gas Engineering.

London, March, 1862.

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MANUFACTURERS OF
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OF ALL DIMENSIONS.
LUMPS, TILES, BRICKS, &c.

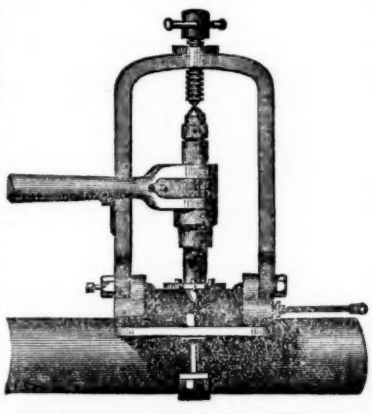
Estimates given on application. Shipping Orders executed with despatch.

LEONI'S Patent ADAMAS GAS-BURNERS are entirely free from liability to Corrosion, Injury from Heat, or danger of Fraction, and are *unalterable* in the dimensions of their Apertures. Uniformity in the consumption of gas is obtained by the process of manufacture, which insures that the burners shall be precisely similar in pattern.

Net Cash Price, 8s. per gross.

For COUNTRY AGENCIES, apply to S. LEONI, 34, St. Paul Street, New North Road, LONDON, N.

SIMMONS'S
PATENT GAS AND WATER CONNECTOR.



This Machine is invaluable to Gas and Water Companies, Gas-Fitters, &c., being the only Connector whereby accidents can be prevented. It is simple in construction, economical in saving the escape of Gas, and can be worked by a labourer.

No. 1 size, to suit ⅜ and ½ in. Services, £6. 6s. each.
„ 2 „ „ ¾ and 1 „ „ £8. 8s. „
„ 3 „ „ 1¼, 1½, & 2 in. „ £12. 12s. „
Including Rachet Brace, Drills, Taps, &c., complete.

MANUFACTURER,
J. COWDY,
BOND COURT, WALBROOK,
LONDON.

Connectors made for fixing on the ends of Mains, to prevent escape in course of laying.

DUPLEX GOVERNOR, for Gas-EXHAUSTER ENGINES.
D. LANE'S PATENT.

This Governor combines great delicacy with remarkable certainty of action. A pressure of one-tenth of an inch of water, operating on a diaphragm of 3 inches diameter, is sufficient to work the Regulating-Valve of an Engine of any power.

TESTIMONIALS.

Borough Engineer's Office, Town Hall
Halifax, March 29, 1862.

Dear Sir,—I have much pleasure in bearing my testimony to the efficiency of your Duplex Governor for regulating the speed of Gas-Exhausters.

The Governor has been perfectly self-acting, and has never given us one moment's thought, trouble, or expense. The engine-man has only to weight the tappets to the required vacuum, and the pressure-register paper never shows a greater variation than three-tenths in the twenty-four hours.

I can very confidently recommend the adoption of it to engineers and managers of gas-works making 50 million feet a year and upwards.

I am, dear Sir, yours faithfully,
G. W. STEVENSON.

Denny Lane, Esq., Cork Gas-Works,
Ireland.

Gas-Works, Cork, April 4, 1862.

Dear Sir,—Having for some time past had in use three of your newly-invented Regulators for governing the speed of Steam-Engines in connexion with Gas-Exhausters, I am glad that I am able to speak of this valuable machine in terms of the highest praise. I have had them applied, as you know, to high-pressure and condensing engines, with Beale's and also Anderson's Exhausters. In every case, this small and valuable instrument is thoroughly effective in regulating the speed of the Exhauster. No amount of care with the hand can equal its accuracy of action for the intended purpose.

Denny Lane, Esq. A. H. STILL, C.E.

An Illustrated Circular, explaining the operation of the Governor, can be obtained by application to D. LANE, 72, South Mall, CORK; and the Governor can be seen in London at the Offices of GEO. ANDERSON, Esq., C.E., 16, Adam Street, ADELPHI.

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London; WATERLOW and SONS, 49, Parliament Street. May be ordered through any Bookseller,

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THE Gas Consumer's Manual,
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SALES OF GAS ACT OF 1859,
AND SUBSEQUENT ACTS.
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Gas Engineers and Contractors for Gas and Water-Works; manufacturers of Steam Engines and Exhausters, Steam Boilers, Gasholders, Cast-Iron Tanks, Purifiers, Condensers, Iron Retorts, Gas and Water Pipes.

Plans, Specifications, and Estimate furnished for new, or for extensions and alterations on existing, Works.

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GRATIS, and post free, "THE INVENTOR'S MANUAL;" also a pamphlet, "*L'Obtention de Patentes Anglaises;*" 500 MECHANICAL MOVEMENTS; the first part of Kinematics, or the Transformation of Motion. By JOSEPH WILLCOCK, C.E., Mem. Soc. of Eng. May be had at the above address, and of any Bookseller. Price 2s. 6d. The second part is approaching completion, and will shortly be announced.

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London Gasholder and Boiler Works,
8, WHARF, WENLOCK ROAD, CITY ROAD, N.,
LONDON.

Rye, Nov. 12, 1860.

Dear Sirs,—I consider it incumbent on me to acquaint you that the alterations recently made on the Rye Gas-Works—viz., the addition of a NEWLY-IMPROVED WASHER, and other work for the Purification of Gas, executed by the experienced workmen under your able supervision—are perfectly satisfactory to the Company, and the Gas is now as pure as it can be made.

I am, dear Sirs, your obedient servant,
CHARLES THOMAS, Superintendent,
Rye Gas-Works.

Messrs. Cutler and Co.

METROPOLITAN BOARD OF WORKS.
MAIN DRAINAGE OF METROPOLIS.
SOUTHERN OUTFALL WORKS, CROSSNESS.

TO Builders, Contractors, and Others.—The Metropolitan Board of Works hereby give notice, that they will MEET at the Office of the Board, Spring Gardens, on Friday, the 4th day of July next, at Twelve o'clock at noon precisely, and will then be prepared to open TENDERS by parties who may be willing to CONTRACT for the CONSTRUCTION of ENGINE-HOUSES, a Boiler-House, Chimney, Filth-Hoist, Coal-Sheds, Dwelling-Houses, Wharf-Wall, Sewers, and other works in connexion therewith, at Crossness, in the parish of Erith, in the county of Kent.

Parties desiring to submit Tenders may, upon payment of £21, obtain Plans, Sections, Specification, form of Tender, and other particulars, on application to Mr. J. W. BAZALGETTE, Engineer of the Board, at the Office, Spring Gardens, between the hours of Nine a.m. and Four p.m.; or on Saturdays, between the hours of Nine a.m. and Two p.m., until Thursday, the 3rd of July next. Half the amount will be refunded to such of the unsuccessful parties who return the Drawings within one week after the day appointed for opening the Tenders.

The Tenders are to be addressed to the Clerk of the Board, and must be delivered at this Office before Four o'clock on Thursday, the 3rd day of July next, and no Tender will be received after that hour. The parties tendering must be in attendance at the Board at Twelve o'clock on the day appointed for opening Tenders.

The Board do not bind themselves to accept the lowest or any Tender, and the party whose Tender shall be accepted will be required to provide two approved sureties for the due and satisfactory performance of the works.

JOHN POLLARD, Clerk of the Board.

Spring Gardens, S.W., May 8, 1862.

CAST-IRON Retorts, Socket Pipes, with Syphons and all requisite Connexions, Lamp Columns, Wrought Iron Tubing, Valves, Street Lamps, Sight Holes, Furnace Doors, Ash Pans, Charging and Coke Shovels, Iron Pails and Coke Barrows, Cross Bars, Fire Pots, Pumps, Iron Borings.

PURIFIERS, CONDENSERS, and SCRUBBERS erected complete, or the materials supplied; with every description of goods in use by Gas-Works, in stock, on wholesale prices, at

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Old Barge Iron Wharf, Upper Ground Street,
LONDON.

ANDERSON'S EXPERIMENTING LABORATORY
AND
GAS ENGINEERING OFFICES,
16, ADAM STREET, ADELPHI, W.C.
(Close to the Society of Arts.)

Mr. ANDERSON continues to Erect, or to supply the Drawings for his PATENT RETORT-SETTINGS. On this principle, three Ovens of Retorts are heated by one Coke and one Tar fire; and, for small Works, the principle is adapted to single Ovens in both cases, with a total absence of smoke, while the duration of the Retorts is from two to three years, and with great economy of fuel.

Mr. ANDERSON continues to supply his PATENT GAS-EXHAUSTER, together with Steam-Engines, &c., erected complete.

This is the most simple machine of the kind in use, being merely a double-action Pump, which any one can comprehend, and works for years without any repair.

Also, his PATENT FOUR-WAY VALVES. One of these valves does the work of three ordinary valves, when applied to Purifiers, Station-Meters, or other Gas Apparatus.

A workman cannot, by any possibility, make the mistake of shutting one passage without opening another; thus ensuring a constant flow of the gas.

All Racks, Pinions, Springs, and other delicate parts of ordinary valves, are in these valves abolished; the Connecting-pipes are also much simplified, and the cost reduced fully 50 per cent.

Also, his CONCENTRIC GOVERNOR, which stands in half the space of the ordinary Governor, and regulates the flow of Gas to the greatest nicety.

Mr. ANDERSON having five Gas-works on lease, besides being engineer to several others, has constant opportunities of perfecting his inventions before they are brought under public notice.

Mr. ANDERSON, in conjunction with Mr. STEVENS, of the Darlington Works, has recently erected and leased for a term of years, two Gas-Works of the Government, one at VICTORIA HOSPITAL, the other at the CAMP at ALDERSHOTT. At both places, the above designs are introduced, and cards to view may be had on application; as also, references to gentlemen who have used his apparatus for years.

Mr. ANDERSON may be consulted on all matters connected with the Manufacture of Gas, the Construction of new, or the reconstruction of old Works, Valuing the same, or obtaining parliamentary powers.

The Laboratory is being fitted up with apparatus for testing the chemical and photometrical properties of Coal-Gas, and also that of Meters, agreeably with the Act of Parliament. Gentlemen desirous of inquiring into such matters, are invited to pay a visit.

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GLOBE PATENT TUBE WORKS,
WEDNESBURY,

Beg to draw the attention of Engineers and Managers of Gas Works to the superior quality of the Article they manufacture, both in respect of the iron employed, and the perfect manner in which it is welded; in proof of which they can refer to the testimonials of the most eminent Gas Engineers, and the experience of the principal of the large Gas Companies of the kingdom.

Orders promptly executed.

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GAS APPARATUS.—W. M. has an extensive assortment of patterns for Purifiers from 4 feet to 15 feet square, also round ones from 4 feet to 10 feet diameter; Scrubbers, Condensers, Washers, Columns, Girders, and Tripod Patterns, suitable for Gasholders, from 10 feet to 150 feet diameter, either Single-lift or Telescope. Contracts for Gas-Works of any Magnitude. Designs, Specifications, and Estimates furnished.

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PIPES and VALVES, for Gas and Water, from 2 inches to 48 inches bore.

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Manufacturer of every description of Fire-Bricks, Lumps, Quarries, Shields, Flue Covers, &c., to any size or shape required.

FIRE-CLAY RETORTS,
TO MODEL OR DRAWING.

B. G. begs to call the attention of Gas Companies to his Fire-Clay Retorts, which have been used with great satisfaction in some of the largest Gas-Works in the Metropolis and many Provincial Towns in England.

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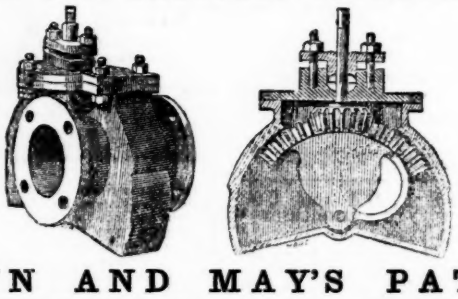
Every article manufactured at their own Works and Mines, Brierley Hill.

FIRE-BRICKS, Lumps, Squares, Tiles, and Gas Retorts of all dimensions.
CRUCIBLE and CEMENT CLAYS.
GARDEN EDGINGS, of various patterns.
BUFF and ORNAMENTAL TILES.
CLINKERS and STABLE PAVINGS, noted for hardness and durability, being perfectly non-absorbent.

Shipments on the shortest notice.

BEST AND CHEAPEST SLUICE-COCK.



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FIRE BRICKS OF EVERY DESCRIPTION, SHAPE, AND SIZE, &c. &c.

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These RETORTS are generally used in the Gas-works of Preston, Accrington, Bury, Heywood, Middleton, Rochdale, Ratcliffe; the Mills of Messrs. Horrocks, Miller, and Co., Preston, &c. &c., and are unequalled in having afforded general satisfaction to those who have given these Retorts a trial.

To meet the increasing demand, the Works at Little Harwood have been greatly enlarged; and Gas Engineers who may favour with an Order may rely with confidence on their being promptly supplied with an article not to be surpassed in finish or durability.

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COCKEY'S PATENT GAS-VALVES.

These Valves are formed of two Cast-Iron Cylinders, with segmental divisions, having the faces ground gas-tight—the upper Cylinder turning horizontally on the lower one.

The lower Cylinder has pipes from each division, communicating with the vessels to and from which the gas is to be passed. The upper Cylinder has corresponding divisions, so arranged as to direct the passage of gas to the different segmental divisions in the lower part, and, when it is turned on the face of the lower one, to alter the flow of gas from one vessel to another.

These Valves are adapted either for bye-passes; for connecting two, three, and four purifiers; or for the inlets of several Gasholders, and are in use for these purposes at the following Works:—

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CANTERBURY.	ELGIN.	MALVERN.	

Besides many small private Gas-Works.

There are Two specimens at the International Exhibition in Class 10; one of them represents the Valve with its Index-Plate fixed for regulation, and the other shows the Valve open, exposing its passages.

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W. R. invites the attention of those preferring the Wet Meter to his patented improvements therein, which consist in contracting the Chambers of the Measuring-Wheel, at and near the Water-Line, thus allowing of a longer range for the Float, and avoiding the sudden extinctions so common; also a simple remedy is applied to prevent the fraudulent consumption of Gas, which the operation of the recent Sales of Gas Act has so much facilitated.

The workmanship and materials are such as to leave nothing to desire.

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Also, DRY METERS OF THE MOST APPROVED DESCRIPTION;

All of the above being Stamped under the Provisions of the SALE OF GAS ACT.

W. and B. C. likewise supply ESSON'S PATENT COMPENSATING FOUNTAINS, and KAY'S PATENT HYDRAULIC VALVES, now so extensively used for bringing ordinary Meters within the requirements of the Act of Parliament. Gas Companies can, therefore, either attach the FOUNTAINS or VALVES to their old Meters themselves, or forward them to W. and B. C. for Alteration and Stamping.

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Manufacturer of Clay Retorts, Fire Bricks, and every description of Fire Clay Goods.

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MANUFACTURERS OF EVERY DESCRIPTION OF FIRE BRICKS, CLAY RETORTS &c. &c.

RETORT MOUTHPIECES, BOLTS, NUTS, &c.

HARRIS and PEARSON, PROPRIETORS OF BEST CLASS-HOUSE POT AND CRUCIBLE CLAY.

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DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for

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ALBERT KELLER, Ghent.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Albert Keller, of Ghent, begs to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by him. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

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Station and Experimental Meters, Gas Pressure Registers, Gauges, Experimental Gasholders, Governors, Slide Valves, &c. &c.

W. and G. would respectfully call the attention of Gas Engineers and Managers to their Station-meters, having made and erected the largest in use at the present time, two of which may be seen at the Stockport and Liverpool Gas Works, on application to the respective Engineers.

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MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

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Muirkirk Iron-Works, 1862.

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This Paint has been proved, by four years test, to stand all the purposes required in Gas-Works, and has the peculiar property of drying over work previously coated with Tar.

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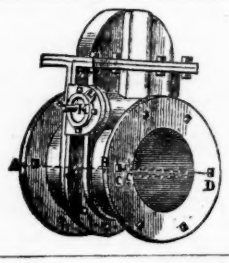

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SELF-ACTING GAS GOVERNOR.

This Instrument, which is designed to replace the ordinary Governor,

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CANNOT BE OVER OR UNDERCHARGED WITH WATER,

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N.B. The Patent Self-Adjusting and Compensating Apparatus may be applied to the ordinary Meter.

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